School-university partnerships for math and science education

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Olga Halina Sosinska

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School-university partnerships for math and science education

Approved by:

Prof. Gordon Kingsley
School of Public Policy
Georgia Institute of Technology

Prof. Juan Rogers
School of Public Policy
Georgia Institute of Technology

Date approved: May, 2007

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CHAPTER 1: Introduction

Education reforms have always been areas of high salience in public opinion and policy debates. Problems in this area have broad implications for all groups in society and debates imply considering such fundamental notions as citizenry, equality of opportunity and freedom. Reforms of math and science education imply these notions as well as the consideration of the role of education and the nation's competitiveness. A strong preparation in the areas of mathematics and science at the elementary and high school levels is crucial for the possibilities of younger generations to pursue higher education degrees, acquire analytical and technical skills and abilities that have become valued competencies in jobs in technology-related fields, as well as being able to consider the possibility of pursuing careers in science, engineering, technology and mathematics (STEM). School-university partnerships set with the goal of improving math and science education present with an interesting type of policy that brings university scientists knowledge and efforts considered as relevant for broad social purposes.

The two problems appear most salient are the persistence of achievement gaps in math and science among student subgroups by race/ethnicity and family income background, as well as concerns about the performance of U.S. students in these content areas as compared to other countries.

Numerous recent reports have called for the improvement of mathematics and science education at K-12 level, presenting many different types of recommendations. In 2006, the National Science Board published a special report along with the yearly Science and Engineering

Indicators especially noting the critical need to revitalize the education system in the areas of math and science in order to maintain a strong foundation that will allow for the generation of future science and engineering workforce, as well as a citizenry capable of thinking critically and making informed decisions based on scientific and technical information (NSB, 2006b: 5).

Mathematics and Science Partnerships (MSP) was originally a program sponsored by the National Science Foundation. The recent No Child Left Behind Act (NCLB) of 2001 established a similar type of policy sponsored by the U.S. Department of Education. It establishes MSP as matching grants for states, and the program is administered by the NSF. These grants are awarded to institutions of higher education partnering with school districts for projects that aim at improving the preparation of math and science teachers, which in turn will improve student's achievement in these content areas. Concerns about the quality of teacher preparation in these areas provide the rationale for these types of policies. It is assumed that improving the preparation of teachers will in turn raise student's achievement. MSP include also initiatives to build capacity at the K-12 level by establishing new types of activities in collaboration with universities for teachers' professional development.

Butz et.al. (2004) have described this type of policy as an interest-building type of policy whose ultimate goal is to encourage the interest of more young students in pursuing careers in STEM fields. Narrowing achievement gaps would allow for increasing the diversity of the STEM workforce (Gaughan, 2005). While the existence of a shortage of STEM workforce has been periodically debated and recent reports point out that such situation is not taking place over the short-run, the relative participation of minorities in STEM fields remains an important area of concern. From this point of view, this type of policy can be considered as a policy that lays the foundations for ensuring the continuation of the critical mass of STEM professionals. Although it

does not have an immediate influence over the "pipeline" or supply of these professionals, it is a critical pre-condition for other type of policies to take place in the future.

One particular feature of MSP binds this type of policy more closely to S&T Policy efforts is the involvement of university scientists from STEM fields in efforts to improve math and science education at K-12 level. Butz et.al. (2004) observe that such spirit reappears in the current university-school partnerships only in a similar way as it was established under the National Defense Education Act (NDEA) of 1958. The NDEA included many provisions and mechanisms for improving the participation of students at higher education level, but it also sought to strengthen the U.S. education system, especially in regards to science education in the aftermath of the launching of the Sputnik. That period was characterized by the increase of the participation of the federal government in funding R&D. The NDEA included various type of instruments that inaugurated the preeminence of the participation of the federal government in regards to strengthening the STEM pipeline, that is the supply of STEM graduates (Butz et.al, 2004: 74), which extends until today. The NDEA also included grants for university scientists for the development of K-12 math and science curricula and textbooks, and funds awarded to local school districts to purchase curricular material and science equipment. The same legislation created Summer Institutes for teacher training sponsored by NSF, an activity that persists until today.

Butz et.al. notice that the "*active interest of university STEM professionals.. in STEM education and curriculum design for K-12 schools*" of that period has now reappeared in university-school partnerships (2004: 75). The program reformulated science education throughout the 1960s decade (Montgomery, 1994: 213), and the successful pace and reach at it was implemented has been pointed out to rely precisely on policies that targeted curriculum,

teacher preparation and local districts simultaneously. Yet from the perspective of educators it presented a mixed success, and Montgomery observed that the program included an overreliance on curriculum over pedagogy, which was regarded by the university scientist leading the program "*even dismissively.. it was the frequent contention of the involved scientists that only 'those who do' were best qualified to instruct 'those who teach'*" (1994: 214).

The NDEA is especially interesting to consider here since the programs were also part of a broader S&T Policy effort, which during that period was characterized by an increase in funding and active policies especially in those areas that were identified as relevant for ensuring the country's economic and military competitiveness.

MSPs involve the participation of university scientists from STEM fields in an activity that is neither their traditional research nor teaching, and can be considered as a particular type of divulgation or outreach activity. These types of partnerships are established among institutions of higher education –colleges and universities- and school districts. Each grant involves the participation of STEM and Education faculty, as well as school administrators and teachers in endeavors of improving math and science teacher preparation. The grant requires that a partnership is formed among them, establishing its own plan of activities and goals, governance mechanisms, as well as evaluation and assessment.

1.2 Policy relevance

As a particular type of policy, professional development schools formed as partnerships between school districts and institutions of higher education are an interesting phenomena to be analyzed from the policy perspective for several reasons. First, the enormous variety of the forms that such partnerships have assumed and the rationale their design has followed is an interesting

reflection of the different standpoints that underlie such policies. The reason for such many forms is the tension between simultaneous movements towards regulation and deregulation of the teaching profession – a situation that Cochran-Smith has described as a "tightly regulated deregulation" that reflect the competing agendas in teacher education:

> *"This seeming contradiction, "tightly regulated deregulation" (Cochran-Smith, 2004a), reveals a major tension in the new teacher education: on the one hand, support for alternate routes that do away with most requirements and make entry into teaching wide open, and on the other hand, centralized federal control that diminishes state- and local-level decisions and greatly prescribes professional discretion and autonomy."*
>
> (Cochran-Smith, 2005: 13)

Second, these types of partnerships reflect a particular arrangement among the different levels of government in an area –education- that in the U.S. has been primarily vested as a responsibility of local governments. Period assessments based on measures of performance are introduced for the purposes of accountability and measuring the impact of different initiatives to increase student's achievement, but the policy also allows for the monitoring of the state and local levels by the federal government. From this standpoint the policy presents a similar spirit to that of the GPRA (1993).

1.2 Methodology

This thesis includes a broad literature review that can be distinguished in three parts: a literature review of policy reports, of literature in education on the formation and operations of partnerships and a literature review on some key concepts in policy and organization theory that are applied here.

The analysis is divided into two chapters. First, a description of the problem of a shortage of qualified math and science teachers is described and a review of the different reports that have

presented concerns and recommendation on such problem is presented. This allows for the application of the public value failure model (Bozeman, 2002) taking into consideration not only the background of the problem but also the policy debate upon it.

Second, an analysis of a survey of a panel of experts on their experiences in partnerships is presented. The analysis presented here consists on simple cross tabulations of the scale questions, and qualitative analysis of the open-ended questions.

The following research steps were carried out. First, a review of literature in education journals was carried out to identify common themes that appear noted as important in the formation and management of operations of different types of partnerships in education. Second, a review of the different reports considered the different policies and debate positions in regard to the reform and improvement of math and science education at K-12 level by improving the preparation of teachers in these content areas. Third, two hypothesis were derived from the original hypothesis to consider more particularly the role that embedded relationships among individuals and alignment of strategic goals and needs have on the operation phase.

The data comes from a four round expert panel comprised by individuals with experience in education partnerships. It was designed and carried out electronically by Michael Washchak, doctoral candidate in the School of Public Policy, and Prof. Gordon Kingsley. The panel gathered the opinions and information on the experience of individuals in partnerships in education. The relevance of considering such data is given not only by the fact that it presents with valuable insights on the experiences and opinions of those involved in the implementation of such policies, but also by the fact that their opinions, beliefs and values are important for understanding the design, implementation and assessment of such policies.

The questionnaire included scale questions measured on Likert scales, as well as open-ended questions. For the qualitative analysis, data was processed by using the NVivo software as well as word processor. Themes that emerged from these responses were categorized following simple summary procedures used in basic qualitative analysis (Miles and Huberman, 1993).

Some of the questions in the survey presented a high proportion of answers that fell under the category of "no opinion", which is considered here as an indication that there might be problems with either the construct validity -i.e., the respondents did not understand the question, which leads to think that the item is not a reliable measure of the particular variable-. Second, the electronic survey was divided into four rounds and the main findings of each survey round were shared with the respondents before carrying out the next survey phase. This was carried out to allow for the creation of shared meanings among the respondents. The drawback of this procedure is that it might be inducing a high level of social desirability bias in the responses the second, third and fourth rounds.

For all of the problems described above, the analysis presented here relies more on the open-ended questions than on responses to scale questions. One of the main independent variables of the second hypothesis was constructed from responses to open-ended questions.

1.4 Research questions

The experts included in the panel had different experiences in partnerships and education, and came from different states and regions across the country.

The first hypothesis considered here is that embedded relationships among individuals and organizations involved in partnerships have a positive effect on the operations phase.

Embedded relationships among individuals are an important source of trust, and this is an effective source of control, easing coordination of activities and compliance with responsibilities.

Taking into account that in the current teacher education reform efforts there are different agendas, as well as orientations towards the reform of teacher preparation and professional development, the second research question will attempt to distinguish different policy orientations as they might appear in the responses.

CHAPTER 2

2.1 A review of mathematics and science education reform at K-12 level in recent policies and reports

Improving math and science education at K-12 level has also been noted as critical for ensuring the building of human capital critical for maintaining the competitiveness of the American economy and maintaining its leading position in terms of innovation. A recent report of the NRC (2007) was commissioned by the U.S. Congress to develop recommendations for enhance the scientific and technological competitiveness of the country. One of its four key recommendations is to "*increase America's talent pool by vastly improving K-12 science and math education*".

The National Commission on Teaching and America's Future (NCTAF), a special commission of experts appointed by the Department of Education, published a report in 2003 observing a "national crisis" in teacher retention (NCTAF, 2003). In 2000, the same Commission had published a report calling for urgent action to improve the performance of K-12 students in science and mathematics (NCTAF, 2000).

In the year 2001, the Committee on Science and Mathematics Teacher Preparation of the National Research Council published a report calling for the need of a fundamental restructuring of teacher preparation and professional development (NRC, 2001). This report concluded that in order to improve student achievement in these content areas, an improvement of teacher

education by providing professional development and reforming the profession to consider career-long type learning. The same urgency for the improvement of math and science education at K-12 levels was noted in reports by the National Science Board (NSB) of the National Science Foundation (NSF) published in 1999, and many other reports and studies.

These reports have in common the recommendation to improve teacher preparation as a way of improving student's achievement. The quality of the preparation of teachers has become an overarching goal of many policies and programs. Furthermore, many reports and studies have shown that not enough quantity of well prepared teachers is also an important concern. The latter have become known as the problems of "teacher shortage" and "quality".

The passage of the No Child Left Behind Act in 2001 has introduced a federal mandate for states to comply with by setting standards of student's achievement as measured by test scores yearly in two grade levels. Title II of the same Act includes stipulations that reform teacher education programs, modifying and broadening some of the provisions and definitions of the Higher Education Act of 1998. Each state is to set the academic achievement standards. Yearly assessments based on test scores of students in the areas of reading or language arts and mathematics, not less than once in the grades 3^{th} through 5^{th}, 6^{th} to 9^{th}, and 10^{th} to 12^{th}. These standards testing were implemented by the year 2005-2006. By the school year 2007-08, assessments on science are to be carried out. These measures have also become as qualifier for receiving federal aid, yet also sanctions that include corrective actions and restructuring. Schools that fail to attain the standard levels are placed on probation, but if they do not improve after two years parents are given permission to transfer their children to other public schools served by the local educational agency[1]. Corrective actions also can involve fundamental school restructuring

[1] Other corrective actions include: replacing school staff, implementing a fully new curriculum including also professional development for staff, decreasing management authority at the school level, restructuring the internal

such as reopening as a charter school or turning over the operation of the school to State authorities. Aid for schools is also tied to providing professional development for teachers.

The introduction of these testing measures has shown that the achievement gaps still persist among minority and nonminority students, as well as that students from low-income and disadvantaged backgrounds consistently perform worse across regions and states as well as within them than students from middle and high income groups. That is a positive aspect of the Act since it mandates the disaggregation of the testing results to enable the consideration of students from different backgrounds by gender, each major racial and ethnic group, migrant status, especially considering students with disabilities and from economically disadvantaged backgrounds, as well as the inclusion of students with limited English proficiency (Section 1111) that were previously excluded from testing. The yearly publication of information on the achievement of different student groups by each state in the "State Report Cards" has given more visibility to the achievement gaps.

Title II of the same Act has introduced more requirements for teacher certification. It introduces the mandate of preservice teachers to comply with new standards for licenses and certification, as well as re-certification for inservice teachers[2]. The mandate redefines and extends some of the provisions included in the Higher Education Act of 1998. Professional activities and the consideration of the teaching preparation as a career long process or continuum that extends beyond certification, is especially fostered. A particularly important concept that is included throughout Title II is the notion of "highly qualified teachers", which encompasses

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organization of the school, appointing an outside expert to advice the school on making adequate yearly progress, extending the school day or the school year for that particular school (Section 1116)

[2] Inservice teacher education are the programs offered to practicing classroom teachers, while preservice education refers to the courses at institutions of higher education that prepare students to become K-12 teachers. The NRC pointed out in 2000 that "there is little agreement about what should constitute inservice education. Programs range from workshops held as part of teacher professional development days during the school year to formal courses offered by peers or at colleges and universities" (NRC, 2000: 187).

those teachers that are certified according to the new standards. It also approves the creation of Math and Science Partnerships (MSP) that follow the program established by NSF and have almost the same goals. There are some important differences among both programs that will be discussed in another section of this paper. The Act also gives a high importance to the reliance on "scientifically based research" as well as "effective practices" for carrying out comprehensive school reforms.

Aspects that have been criticized of this Act are it's overreliance on tests scores as a measure of achievement, at the expense of devoting resources to improve other aspects. In some cases it has been pointed out that it encourages a "short term mentality" (AAAS, 2005: 19), due to the overreliance on test scores as measures of student's achievement and teachers' performance. Another aspect that has been criticized in the same way has been the encouragement of alternative programs for teacher preparation, which have been pointed out by some experts as "quick fixes" to increase the supply of teachers.

The following section will describe in more detail the different reasons that have been pointed out as part of the problem of what the NSB has described as an intractable "widely recognized systemic failure" (Letter of Transmittal, NSB, 2006b).

Finally, it is important to note here that there have been other programs for improving math and science K-12 education nation-wide through initiatives that included the participation of university scientists. Through 1991-93, the National Science Foundation funded the Statewide Systemic Initiatives (SSIs), whose goal was to improve achievement in math and science by fostering the alignment of different components of the education systems in twenty five states (CSSO, 2000). Partnerships between the state education policymakers, higher education as well as business organizations were established for the development of strategic plans and visions of

education reforms. In some of these partnerships were implemented in the organizational structure of existing educational institutions, while in other they assumed the form of a non profit advocacy organization coordinating a state partnership (CSSO, 2000: 8).

Following these programs, the NSF funded the Urban Systemic Initiative (USI) and the Urban Systemic Program (USP), both with the goal of improving achievement in math and science in urban school districts that served students from minorities and economically disadvantaged backgrounds, while at the same time was carrying out systemic reform at this local levels. The program presented successful outcomes in several cases, both improving students' achievement and building capacity at the local level of the education system (AAAS, 2005). These programs assumed the rationale that in order to improve student's achievement in these content areas reform efforts should be targeted not only to teachers but to the entire education system.

Organizations such as the American Association for the Advancement of Sciences (AAAS) have been carrying out programs for improving science literacy at K-12 level for more than two decades: Project 2061. The program has been very active in the development of standards as well as benchmarks for science curricula, classroom material, as well as providing with training opportunities for teachers in these content areas.

2.2 Relevance

First, a strong preparation in the areas of science and mathematics at elementary and high-school levels is crucial for the possibilities of young people to think about the possibility of pursuing careers not only in Science but also in many other professions that require analytical competencies of this kind. Second, the disparities in educational achievement of minorities and

children from low-income families in these areas reinforce the latter and more broadly reintroduce the problem of ensuring a quality education for all students. It is easy to presume that students that did not do well in these content areas or did not have access to good education at K-12 level, will not think about the possibility of pursuing higher degrees in STEM fields.

Disparities among students from different population groups are not only in regards to achievement in these areas, but also in regards to access to more advanced courses and curricula as well as having high quality teachers. For example, 66% students pursuing undergraduate degrees in engineering took Advanced Placement courses in science and/or math at high school level (NSB, 2006a). Yet these types of courses are less available in rural areas and schools attended by students from low-income families. The NSB (2006b: 3) observes that there persists a growing inequality among K-12 students in regards to access to solid math and science education, as well as the prerequisite courses for entering colleges and universities.

Education policy and reforms are always an important area of policy debate and salience, not only in the U.S. but also elsewhere. It is an area in which different reforms and policies have been designed and implemented. Following Schneider's and Ingram's characterization of policy designs, and in a broad sense, it is possible to consider among the different types of policies in this area according to the different "targets" they assume: students, teachers, schools, states. In the case of the latest wave of reforms, a stronger emphasis has been given to improve the quality of teacher preparation in math and science by establishing partnerships among schools of education and other organizations. Hence, these policies imply the goal of improving student's achievement in these content areas by first improving teacher preparation. An overview and discussion of the different types of education reforms that have taken place over the last decade,

and how does the MSP policy particularly fit into this context will be presented in a separate section.

The MSP is a program sponsored by the National Science Foundation (NSF) in the form of grants awarded to a set of organizations that must include K-12 organizations and lead by a university. A particularly distinctive feature of this program is that it involves not only faculty from the Education departments, but faculty from the Sciences departments as well. As it will be discussed in the following section, it can be considered as part of a bottom-up type of policy.

In order to understand the current education policies and reforms, it is important to note as Cochran-Smith points out that different rationales and enduring tensions persist in these debates and rationales: the tension on the criteria for diversification and selectivity of the teaching workforce; tension of the importance of pedagogy and subject matter knowledge; on the role of universities and other providers; and the tension between the regulation and deregulation of the teaching profession[3] (2005, 12-13). A crucial aspect is to note that even in the case of policies that resort to the same type of policy tool -such as it is the case of partnerships among school districts and institutions of higher education- very different types of rationales are implied.

A brief description of the main policy debates of the 1980s and 1990s allows to understand better the current situation. The first report that observed an urgent need to improve K-12 education nation-wide was published in 1983: *A Nation At Risk*. Three years later, the American Association for the Advancement of Science (AAAS) established a special and permanent program to improve science literacy at K-12 level: Project 2061. The program has

[3] Cochran-Smith (2000) observes two main orientations toward teacher education reform in recent years: "*The first, which is intended to reform teacher education through professionalization so that all students are guaranteed fully-licensed and well-qualified teachers, is based on the belief that public education is vital to a democratic society. The second, which is intended to reform teacher education through deregulation so that larger numbers of college graduates (with no teacher preparation) can enter the profession, is based on a market approach to the problem of teacher shortages that feeds off erosion of public confidence in education.*".

engaged scientists and K-12 educators for the improvement of science education, establishing different types of activities as well as materials, and more recently standards for science literacy, in an effort to improve instruction for all American students.

Education policy can be characterized by two broad reform efforts: the equity and excellence movements. The equity movement sought to promote equality of educational opportunity regardless of race, gender or class (Euchner and McGovern, 2003: 229) and it encompasses from desegregation efforts to school finance reforms. The excellence movement is characterized as beginning with the publication of the *A Nation at Risk* report. This movement sought to improve the quality of K-12 education and introduced proposals such as a basic curriculum, increased used of standardized testing for the measurement of students' achievement, and well as test-based competency and improved teacher training (Euchner and McGovern, 2003: 210). The standards reform characterized state reforms during the 1990s had also its impulse in teacher professionalization movement. In the 1990s, efforts to reform the administrative structure of education systems and is exemplified in the school choice, vouchers and charter school programs.

2.3 Background of the problem

2.3.1 Student achievement in math and science

Recent studies indicate that achievement in the areas of science and mathematics at K-12 level has risen, as compared to previous years. Especially in the area of mathematics, and at elementary school level, achievement as measured by test scores and reported by the NCES have risen for students across all types of background (that is race/ethnicity, gender and income groups) (NSB, 2006a). The consideration of only test scores as a measure of achievement is

nonetheless controversial and needs to be supplemented with other indicators. The National Assessment of Educational Progress has reported that in spite of the improvement in test scores, most students in 4th, 8th and 12th grades do not demonstrate proficiency in mathematics (NSB, 2006a: 1-13). Achievement in the area of science did not improve over the 1996-2000 period as measured by test scores, and declined for students in 12th grade. The rates of students achieving proficient levels in these areas is similar to the one in the area of mathematics, but much lower for students in 12th grade (NSB, 2006: 1-16).

Achievement gaps persist among different groups. While there are indications of a narrowing gap among girls and boys, gaps persist and are substantial among ethnic groups and low and middle and high income groups. Achievement at high school levels in the areas of science and mathematics presents less optimistic indicators.

Another indicator that has received wide attention is the performance of U.S. students as compared to other countries. Two assessments are taken into account for this. The *Trends in International Math and Science Study* (TIMSS) assessment compares curriculum based skills in math and science of 4th, 8th grade students from rich and developing countries. The study measures how well students master the mathematics and science content covered by their school curriculum (NSB, 2006a: 1-23), and measures achievement in the curricular area common to all these countries (NSB, 2006: 1-52). In the 2003 assessment, U.S. students at each of these levels scored higher than the international average both in math and science. While there were no important changes in the performance of U.S. students in the 2003 and 1995 TIMSS assessments, there is indication of a slight improvement in the 8th graders scores both in math and science in 2003.

Another assessment is the Program for International Student Assessment (PISA) that measures the mathematics and science literacy of 15 year old students in the thirty OECD countries and eleven non-OECD countries. In contrast to the TIMSS study, it measures student's math and science literacy; that is to say, the ability to apply mathematical and science concepts to "*problems they might encounter, particularly in situations outside of a classroom*" (NSB, 2006a: 1-23). Both in mathematics and science, but especially in mathematics, U.S. students scored lower than the international average. In mathematics, U.S. students scored higher than only five other OECD countries and six non-OECD countries. In science, U.S. students had scored among the OECD average in the year 2000, but in 2003 their scores were lower. The latter is attributed to the relative improvement of other countries in their performance in this content area over this three year period (NSB, 2006a: 1-23).

2.3.2 Math and Science teachers

Both the quality and quantity of math and science teachers have become important areas of policy debate. In regards to quality, the improvement of math and science teacher preparation has been a concern and target of different education policies since the 1980s and is also reinforced by the recent NCLB Act. In regards to quantity, there have been numerous studies and reports debating a shortage of teachers especially in these content areas, which is largely motivated by high attrition rates of new teachers in their first five years of practice. Furthermore, high levels of mobility of teachers across school districts aggravate also the problem for particular schools.

Problems of math and science teacher quality and quantity have been lead to the existence of what has been denominated "out-of-field" teachers – defined as the "*mismatch*

between the subjects a teacher teaches and that teacher's academic training and/or certification" (NSB, 2006a: 1-55)-. The magnitude of teachers in this category has been a driver of many federal and state policies of the late 1990s. The NCLB Act has established the requirement of certification and a college minor in the subject taught as two necessary credentials for teaching core subjects at elementary and high school level. Teacher certification takes place after they had finished the preparation requirements, which usually include completing a bachelor's degree, completing a period of teaching practice and passing one or more exams (Kaye 2002 cited in NSB, 2006a: 1-34). Certification is usually carried out by state education agencies or teacher professional associations.

The U.S. Department of Education reports that the total number of teachers in the country is 3.2 million, of which only 2.5% was not fully certified by the 2004-2005 school year. For the period 2003-2004, 40 states required testing for initial teacher certification. From 2005, 34 states require a content specific bachelor degree for initial teacher certification. In the content areas of mathematics and science, 25 states had implemented teacher standards by the year 2005 (U.S. Department of Education, 2006: 34).

Disparities exist among states, but they are even more pronounced among high poverty districts and other school districts. Some reports and studies have observed that teachers with less preparation are often assigned to schools in low-income districts as well as to classes with more low-achieving students (CCSO, 2000: 15).

A recent report by a private foundation observes that only twelve states have made progress towards solving the shortage of qualified science and mathematics teachers (NCTQ, 2007: 10). Some states have employed in large proportions teachers certified in other states. Another indicator are waivers - "a temporary or emergency license permitting a teacher to teach

without full certification or licensure" (U.S. Department of Education, 2006: 36). In seven states there are no teachers reported in such condition. While in the majority of the other states have rates below 5%, in the state of Maryland as much as 14.5% of teachers were on waivers during the school year 2004-2005. Almost one-third (28%) of the teachers that were on waivers during the school year 2004-2005 taught at high-poverty districts (op.cit, page 40).

Across all states and territories, for the same period, 3% of all mathematics teachers and 2.9% of science teachers at secondary levels were on certification waivers (U.S. Department of Education, 2006: 73). 71% of all math teachers and 77% of science teachers at 7-12th grades levels held a minor graduate certificate in their content area in the period 1999-2000 (NSBb, 2006, table 1-22). These proportions vary considerably by state. In math, as many as 90% of math teachers held a minor in their content area in Arkansas, but as little as 48% in Nevada - in science, as many as 93% in Minnesota but as little as 49% in Louisiana. In the last years these figures have improved due to progress in the implementation of the NCLB.

Teacher Professional Development policies aim at providing different courses and programs for the update and continuation of learning of teachers throughout their careers. These types of policies had been an important rationale of the different reforms and efforts of the last two decades aimed at improving teacher professionalization since they do not target preservice but inservice teacher education. These types of policies have encompassed a wide variety of different efforts, and their variation by state has also been considerable (NSB, 2006a: 1-36). These have ranged from the initial format of course programs such as seminars provided by consultant or experts, workshop and conferences, to the most recent approaches that stress the importance of programs of "extended duration, collective participation of teachers in school, active learning opportunities, focus on content, and coherence with other activities at the school"

(NSB, 2006a: 1-36). Workshops and traditional conferences are still the dominant form of professional development programs that teachers attend (NSB, 2006a, op.cit.). The requirements vary depending on the state, but usually they include completing professional development courses each five years, although in some states it can be up to ten years. In 2004, in fourteen states the requirements consisted in fulfilling six credit hours of coursework (CCSO, 2005: 35).

The development of programs that would differ from the traditional ones requires more financial and time resources than the early type of workshops did, and has given way to the development of initiatives such as partnerships among different organizations as a way of solving this by joining resources among states, school districts, and different types of organizations. Although the participation of teachers in such programs has risen, workshops and conferences are still the dominating format and the amount of time assigned to these types of programs remains as low as 8 hours per school year. School-university partnerships may provide with new types of professional development that includes novel type of activities such as inquiry and practical experiences in these content areas.

2.3.2.1 Teacher quality

There have been widespread calls for making professional development part of a continuum of the teacher profession and preparation, yet how this should be carried out has fewer consensuses. One important area of concern in regards to math and science education is the provision of subject content knowledge to teachers, and pedagogical instruction. The emphasis in the NCLB and some recent initiatives has been on the first, and it is also implied in the rationale for recruiting teachers from PhD graduates and similar initiatives. Yet pedagogical instruction is as an important part of teacher preparation as content knowledge. Critics have

pointed out that best material without adequate preparation does not make a difference, and that the current federal and state legislation for teacher certification and professional development the importance of pedagogical instruction is underscored by the emphasis given to curricular contents (Cochran-Smith, 2005: 12). Yet pedagogy is as an important part of teaching as is content knowledge, and this is especially true in the areas of math and science, where the didactic to make the content knowledge accessible and understandable is crucial. It is difficult to think how this type of instruction can be provided by STEM faculty, and not Schools of Education.

Inquiry based programs for professional development aim at providing teachers with practical experiences in research type of activities that can allow for better instruction through attaining this type of "hands on" experience.

"Teacher effectiveness" is defined as the teacher's ability to change student's achievement, as well as adapt and update knowledge. Studies have shown that professional development programs increase teachers' effectiveness since they not only provide with new content knowledge on particular subjects but also new instructional and pedagogical practices. Other studies have shown that teacher effectiveness can be enhanced in environments that support and value their work and can be diminished by poor working conditions, lack of professional support, widespread student problems, and inadequate facilities and resources (NSB, 2006a: 38).

2.3.2.2 Shortage of highly qualified math and science teachers:

the problems of attrition and mobility

There have been several reports, such as for example NCTAF (2003) or The Teaching Commission (2006), that have called upon a national crisis of teacher shortage. This study stresses that instead of a problem of supply –the quantity of the teachers that graduate each year-, the shortage is due to the this high rate of attrition (NCTAF, 2003: 23). In fact, the reports presents data from the 1987-2000 period showing that the amount of teachers leaving the profession in 1993 and 2000 was higher than that of new teachers entering the profession, a situation that was not taking place neither in 1987 or 1990. Furthermore, while the total teaching workforce rose by 23.8% between 1987 and 2000, the amount of teachers leaving excluding retirees rose by 33.7%. The same report states that the annual turnover in the teaching profession is higher by four percent points (15.7%) than that average in other professions (11.9%). Furthermore, there is also concern on the possible shortage of teachers in the near future considering the magnitude of teachers retiring in the next years along with the increase of incoming students due to the increase of the population.

Other studies have shown that the problems is more complex, at that it consists not on a problem of shortage in the supply of new graduates that enter the profession each year, but is caused by a high rate of attrition of novice teachers in their first years of practice. This results in a shortage of teachers which is further exacerbated by a problem of disparities of the provision or distribution of teachers among different regions and local areas, caused by problems of teacher's mobility across schools and school districts (NCTAF, 2003; Darling-Hammond and Sykes, 2003). High rates of new teachers leave the profession in the first five years of practice, or

change the school at which they work. These problems have been reported to be even more important in the case of mathematics and science teachers.

There are indications that teacher attrition in the content areas of math and science has been rising over the 1987-1990 period: while in the 1987-88 and 1988-89, 5% of math and science teachers left the profession, in 1999-2000 and 2000-2001 it had risen to 7 and 9% (NSB, 2006a: 39). This points out to difficulties experienced by novice teachers in their first years of practice. Current initiatives that include mentoring or induction program, as well as targeted professional development aim at improving the working conditions and learning of the job (NRC, 2001).

The attrition rates for mathematics and science teachers are slightly higher than those for teachers of other content areas. The amount of vacancies and the difficulty in filling them is another indicator for considering the magnitude of the shortage. For the year 2003-2004, 55.6% schools in the U.S. reported vacancies for math teachers

Table 1. Percentages of all public and private schools that reported teaching vacancies and difficulty to fill them, by selected content areas (1999-2000 and 2003-2004)

	Mathematics teachers		*Biology or Life Sciences teachers*		*Physical Sciences Teachers*		*English as a second language*	
	1999-2000	2003-2004	1999-2000	2003-2004	1999-2000	2003-2004	1999-2000	2003-2004
Reported vacancies	54%	54%	44%	44%	36%	36%	16%	33%
Reported very difficult or not able to fill the vacancies	42%	27%	30%	20%	27%	27%	12%	31%

(Source: National Schools and Staffing Survey, NCES, U.S. Dept. of Education data reported in Strizek et.al, 2006 (Tables 15 and 16); and Ingersoll, 2003)

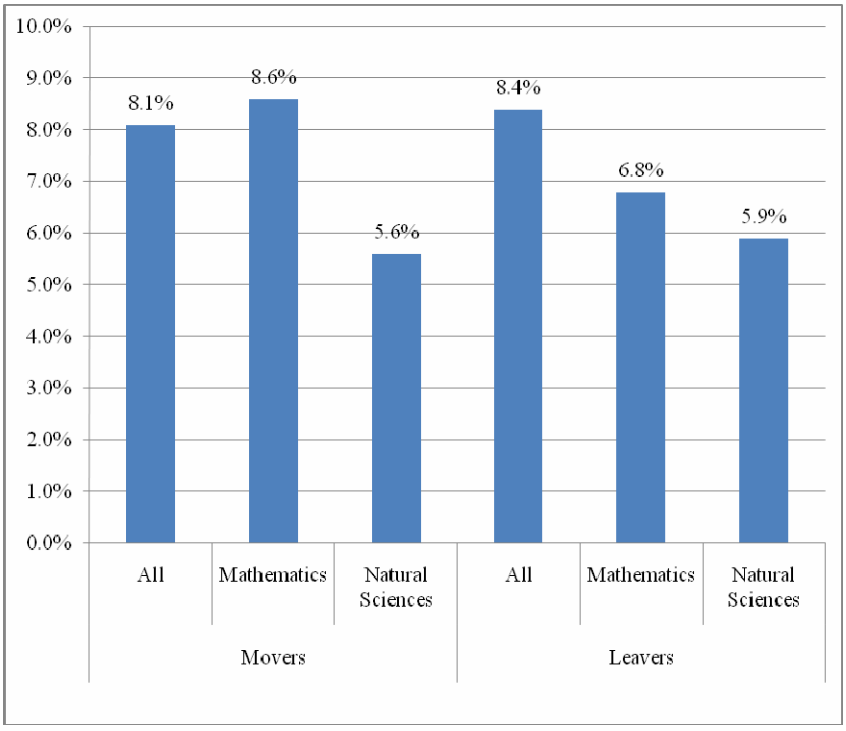
It is important to note that the category of those that leave the profession includes an important proportion of teachers that do so temporarily – stop teaching for some years but then come back to this type of work. Nonetheless, there are indications that the proportion of teachers that leave the profession permanently is high. For the year 2004-2005, 25% of the teachers that left public schools cited as an extremely or very important reason pursuing another career (Marvel et.al, 2007: table 6). For the year 2000-2001, math and science teachers that left rated significantly higher than other teachers that following reasons for leaving the profession: pursuing another career, obtaining better salaries in other jobs, dissatisfaction with changes in the job description and responsibilities (NSBa, 2006: 40).

Mobility of teacher among school districts creates staffing problems for particular schools, exacerbating what appear as shortages at local schools and districts level but are in the aggregate problems of distribution among different areas and types of schools. A common reason for teacher mobility are working conditions problems, and mathematics and science teachers report these reasons more often than other teachers (Ingersoll, 2003). Teachers changing the schools at which they work create particular staffing problems for some schools, which in many school districts is neither an easy or fast procedure.

Furthermore, there have been studies that point out that rates of mobility and attrition are higher in low-performing schools, as well as low-income central city districts as compared to well performing schools and suburban school districts (Darling-Hammond and Sykes, 2003; Ingersoll, 2003). The different levels of funding that these different types of districts have further aggravate the problem. Some authors have noted that this creates an important problem of distribution of teachers –especially highly qualified teachers- across school districts, which underlies the phenomenon that appears as a generalized shortage (Darling-Hammond and Berry,

1998 cited in NRC, 2001: 73). Data from the last School and Staffing Survey (2003-2004) does not allow extrapolating the finding of such differences to nation-wide.

Figure 1. Teachers that leave the profession or move across schools by content area (2003-2004)



(Source: U.S. Department of Education, National Center for Education Statistics, Schools and Staffing Survey (SASS), "Public School Teacher Data File," 2003–04; Teacher Follow-up Survey (TFS), "Current and Former Teacher Data Files," 2004–05. In Marvel et.al, 2007, table 2)

Several reports and studies have found that teachers attrition is high in the first years of practice (Darling-Hammond and Sykes, 2003; Ingersoll, 2003). Data for the school year 2003-2004, shows that almost 20% of novice teachers with no full-experience leave the profession in their first year of practice.

Table 2. Teachers that move or leave the profession, by years of experience (2004-2005)

	Movers	Leavers	% of group	N
No full-time teaching experience	17.1	19.6	36.7	28,100
1-3 years	14.8	8.1	22.9	598,300
4-9 years	9.4	7.9	17.3	867,200
10-19 years	6.3	5.5	11.8	812,600
20 years or more	3.9	11.2	15.1	908,600

(Source: Marvel et.al, 2007, table 2)

Another type of policies and mechanisms that have been put in place to increase the magnitude of teachers have been financial incentives other than salary increments and bonuses. Eighteen states had some type assistance policy in place in order to attract new teachers into identified areas of shortage, such as high poverty area schools (U.S. Department of Education, 2004: 28).

Finally, there have also been initiatives to recruit teachers from particular pool of university students. For example, the National Research Council (2002) have presented a program proposal to recruit science, mathematics and engineering PhD graduates to careers in K-12 education, by establishing post-doctoral types of fellowships. Besides improving teaching in these content areas and providing with job opportunities for those doctoral graduates that prefer alternative career pathways to industry and academia, the program also aims at establishing a better communication between schools and university science departments.

2.4 Applying the public value failure model

Foremost, this is a type of policy in which the application of the public values failure model serves as an important tool both to define as well as provide guidelines for decision making. Applying the public value failure model to this case allows considering the policy and

the problem it seeks to address in terms of the public values and public interest as main criteria for assessment. More particularly, it allows considering this policy in terms of investments in science that yield public value.

As an analytical and operational tool, it allows to define the problem in terms that exceed the sole consideration of shortages in the supply and demand of highly qualified teachers, by providing public values as the criteria for assessment. The application allows for a different problem definition that would be developed otherwise, providing with criteria that can aid for decision making and recommendation from the standpoint of public interest (and not solely efficiency concerns).

The shortage of highly qualified mathematics and science teachers was noted as an example of the public failure of scarcity of providers (Bozeman and Sarewitz, 2002: 8). Scarcity of providers occurs when "*despite the recognition of a public value and agreement on the public provision of goods and services, they are not provided because of the unavailability of providers*" (Bozeman and Sarewitz, 2002: 6). The numerous reports, studies and policies cited here demonstrate that the shortage of highly qualified teachers is a matter of wide debate and is a public value currently discussed extensively. Considering that elementary and secondary education are a fundamental way in which equality of opportunity is provided, the scarcity of high quality math and science teachers is a public failure by not providing the opportunity of access and exposure to knowledge and skills that are highly relevant in the current era.

Furthermore, concerns on the shortage of highly qualified math and science teacher have spurred many initiatives for alternative paths for teacher preparation and certification. These have assumed different forms, ranging from shorter programs of study to programs that aim at recruiting new teachers from pools of mid-career professional in other fields, new PhD graduates

in STEM fields, or bachelor graduates that had not considered the teaching career. These types of programs often involve a shorter coursework preparation, which overlaps with the faster placement of novice teachers in classrooms. Many critics have noted that in spite of its goals, these types of programs are "short term fixes" that do not improve the shortage of these types of teachers over more extensive periods of time. The high rate of attrition among novice teachers in their first years of practice, as well as studies that have shown that participants of some of these programs leave the teaching profession after the completion of the program, indicate that this might be the case. The allocation of resources to these types of policies and programs might be rendering only temporary results. The application of the criterion of short term horizon allows considering another type of public failure in this case: a short time horizon. This type of public value failure occurs when "*a short term horizon is employed when a longer-term view shows that a set of actions is counter to public value*" (Bozeman and Sarewitz, 2002: 6). Recruiting novice teachers from alternative pools of applicants through special programs that do not solve the reasons that lead to the attrition of math and science teachers does not solve the antecedent cause of the quality teacher problem. Such allocation of resources are not serving public interest since they involve only a temporary solution for a problem that will persist and even encompass the novice teachers that graduate from this programs. A sole increase of the supply of math and science teachers does not solve the problems that lead to their attrition in the first years of practice. From a longer term view, these programs may run counter to the goal they aim at and even contribute to what has been described as an "*intractable systemic failure*" of the education system (NSB, 2006b).

The MSP initiative at least in principle is not falling into the latter category since it involves a more systemic type of approach, aiming at providing professional development for inservice teachers and building capacity that can sustain reform efforts.

As it was noted before, the persistence of achievement gaps among students from minority and disadvantaged backgrounds in regards to their peers from non minority and more socioeconomically privileged backgrounds at in K-12 level, has also important consequences for the opportunities to develop a diverse STEM workforce (Gaughan, 2005).

CHAPTER 3: Literature Review

The purpose of this chapter is to provide a literature review on partnerships as a policy tool, and more particularly partnerships in education. The first section considers partnerships in different policy domains in the attempt to distinguish the distinctive features of this type of policies and programs. The second section reviews different types of partnerships in education and draws from different type of literature mostly from academic, evaluation and praxis literature. Overall, this is a broad literature review in regards to the topics as well as the type of literature considered.

In the second section, an overall aim was to identify the recurrent themes that appear in the literature about the characteristics of partnerships and the activities they encompass. The review considers not only academic articles publishing research findings or the results of different types of assessments, but also some opinion articles published by participants in such endeavors. The latter is included guided by the aim of tracing themes that emerge from the accounts of those actors involved in the formation and development of school-university partnerships. Not only opinion and essay type of articles –or more broadly, non-empirical articles- were considered for this purpose, but also literature following constructivist and participatory approaches was considered as particularly relevant. To some extent, although it is not a primary source of information/data it provides with an important source for information for understanding how partnerships operate in practice. Many of the articles were produced by researchers, educators, and administrators that have been involved in partnership experiences.

The relevance of such endeavor is to consider the production of those actors that have been more closely involved in the development of such partnerships.

This review follows other reviews (Waschak and Kingsley, 2006) and the aim is to consider the hypothesis established by these authors in regards to partnership formation which stipulates that embedded relationships and alignment of strategic goals among partnering organizations ease the formation process. Such hypothesis was considered in the review of the most salient themes that appeared in the literature, and in the last section of this paper a reconsideration of it is proposed.

3.1 Partnerships

The dictionary definition of a partnership is "*a relationship usually involving close cooperation between parties having specified and joint rights and responsibilities*" (Merriam-Webster's Dictionary). Partnerships have been used as a particular type of public policy in different areas and for different purposes, and their particular definition remains elusive.

Partnerships among public and private organizations have become common in other types of policy domains such as S&T Policy and urban development, and others. These can be considered broadly as public-private partnerships. In the U.S. these types of inter-organizational arrangements are not an entirely novel type of policy, given the country's tradition of decentralization and administering federal aid through grant programs awarded to organizations at local levels. From a broader standpoint, public-private partnerships have been also considered as an alternative to privatization of public services and contracting out that has gained preeminence in "third way" types of policies. Franklin describes education partnerships as "*networks that establish patterns of association and interaction that link the state to civil society*

with the intent of forming interconnections, introducing flexibility, and structuring individuality and citizenship" (Franklin, 2003: 3). Again, in the U.S. such initiatives are not strange at all to the long-standing tradition of intermediary institutions and high local participation of the American democracy.

Since MSP are encompassed in a broader policy movement toward regulation or de-regulation of this type of program, Gromley (1986) consideration on the typical attributes of these types of policy situations by their salience and complexity might be in place here. The current debate on the improvement of math and science education can be characterized as an area that has high salience, as it is reflected in the numerous reports of different professional associations, governments, news articles; and high complexity. The improvement of teacher preparation involves the redefinition of the "regulation" of teacher certification. This has been a topic of extensive academic and policy research, and the different types of policies and initiatives that have been tried out over the last two decades in this area reflect a quite sophisticated level of technical knowledge. The development of standards for teachers as well as students achievement has been carried out through numerous studies commissioned to experts in academia and professional associations; the measurement and interpretation of test scores is an area of government and academic research on its own. According to Gromley's typology this type of policies would respond to operating rooms dynamics, in which upper-level bureaucrats and a high level of technical knowledge would dominate in decision-making processes. A particularly interesting aspect of the MSP program, is that it is based –either implicitly or explicitly- on the rationale of allowing the design and implementation of programs for teacher preparation to the variety of actors most involved in these areas, as well as it allows for its carrying out at local levels.

In education, partnerships encompass a wide array of initiatives aimed at providing professional development for teachers by establishing inter-organizational arrangements among schools, school districts and institutions of higher education (colleges and universities). Partnerships were the main policy instrument of the Systemic Reform Initiatives sponsored by the NSF throughout the 1990s which among other results contributed to the development of math and science standards at the state levels (CCSO, 2000; AAAS, 2005). In the context of the MSP, partnerships involve a set of different organizations working together on the same project: universities, K-12 and other types of organizations that can be for or non for profit. The common characteristic between the SSI and the MSP programs is that both entail establishing a particular inter-organizational arrangement among institutions of higher education, school districts as well as other organizations including non profit and for profit ones. In the case of the SSI, the state education agencies were also involved.

A finding that emerged from the SSIs program was "*the potency of local context, i.e., strengths and weaknesses in implementation (in the field), as opposed to the robustness of the concept and design of "systemic reform" (by the sponsor)*" (AAAS, 2005: 12). The SSIs program, as well as the USI and RSI programs, a report by the AAAS (2005: 5) found factors that lead to more successful reform were:

- Ownership & Accountability: involvement of stakeholders in planning
- Resources, notably time
- Data & Research-based Practices
- High Expectations & High Standards
- Management & System Capacity
- Implementation & Technical Assistance

These factors are considered as a set of interrelated reasons that have an interrelated effect upon the success of the program. Katzenmeyer and Lawrenz observe that the *"emphasis at the present time is in funding partnerships and aligning with the No Child Left Behind legislation. The partnerships focus on changing various institutions so that they will better interact with others. The ultimate goal is often improved student achievement and lessening of gaps between types of student achievement. Therefore, evaluation of the partnerships includes heavy emphasis on accountability and direct ties to state-based testing systems as well as means to measure organizational change and interaction."* (2006: 10).

There are two broad orientations towards the reform of teacher's professional development: those approaches that advocate for more systemic type of efforts, such as SSIs and the school-university partnerships of the NNER and Holmes Group; and an approach that gives more importance to measures of teachers and students performance alone as outcomes measures. While both may be the same policy goal, they prescribe different policy rationales. The first orientation should give more importance to changes in the capacity of local institutions and individuals, and in consequence it gives more importance to process outcomes as progress measures. In contrast, the second approach tends to imply an input-output rationale in which the alignment of efforts among different institutions and organizational change are overlooked becoming part of a "black box" set between the inputs of highly qualified teachers and the output of student achievement.

Partnerships in education have been established among schools and communities, teacher education programs and universities, as well as among schools and for and non for profit organizations. They encompass Professional Development Schools and programs that are designed for certified (graduated, inservice) teachers to attend to further develop their skills.

Originally established by the Higher Education Act of 1998, the mandate on these types of schools has been redefined under the NCLB of 2001. Currently, it is the responsibility of state governments to administer and certify teacher licenses. In addition to a bachelor's degree, teachers must take one or several tests to become certified, and the requirement vary in each state.

Professional Development Schools (PDS) are described as partnerships, almost interchangeably as it is shown by a report of the Committee on Mathematics and Science Teacher Preparation of the National Research Council in which they use the term PDS to "*describe an intentional partnership between a college or university and the K-12 sector for teacher education and the improvement of teaching and learning in the schools*" (NRC, 2001: 5). The same report recommended the development of long-term partnerships between school districts and two or four year colleges and universities through which a reform of teacher preparation in these areas would be carried out, not only in terms of curricular content but also modifying the way it is provided. These imply a wide spectrum of different types of partnerships, which include different types of providers (including non profit organizations, consulting firms, as well as industry), to initiatives focused on particular target groups such as partnerships among school districts, local communities and other organizations set in disadvantaged urban districts.

3.2 The education system and education policies

The education system in the U.S. is under the jurisdiction the local and state levels of government, but it is not extent of multiple direct and indirect mandates from the state and federal levels of government. Nonetheless, the implementation of public education policies is carried out by locally managed school districts and hence critical actors in this process are the

school district superintendents, as well as school boards, the state level education department, state level legislators. Schools and teachers are the most common targets of education policies, and they are of course also critical for their successful implementation.

The involvement of the federal government is given through many indirect policies as well as the provision of aid programs, especially remedial and special education programs.

The setting of standards has been responsibility of state governments and has been underway since the 1990s, but its monitoring by the federal level has become a stronger mandate after the passage of the NCLB. The setting up of standards across curricula and teaching licenses and certifications, as well as measuring their attainment through period testing and monitoring is an important mechanism by which the federal and state levels of government have increased their coordination role. Given the strong tradition of local responsibility over education, this represents an important reform.

Studies in implementation have observed the difficulties that arise when multiple actors and levels of government are involved in the implementation of a policy, which is most frequently the case. In regards to education agencies and school districts, Meier and O'Toole (2003: 690) have observed a "network" type of management in this kind of settings, due to the multiplicity of actors involved in education reforms. Weak vertical linkages between state policies and their implementation in schools have been observed as a common characteristic in many states. Partnerships may imply the aggregation of one more actor to this policy arena or domain, and since they are defined in terms of an inter-organizational program the consideration of some of the problems observed early by Montjoy and O'Toole appears still pertinent here: *"inter-organizational problems arise largely from the difficulty of coordinating the activities of several different units, each of which has its own goals and established routines.. a solution to an*

intra-organizational problem may exacerbate an interorganizational problem" (1979: 473).

The literature review presented here considers partnerships in education other than MSP, with the hope that some of those previous initiatives lead to insights that might be extrapolated to these newer types of activities. Partnerships in education have been carried out in two main areas: Professional Development Schools (PDS) for teacher preparation, as well as efforts for reform of urban schools. This literature review concentrates more on the first than the latter, given the main goal of MSP.

A particular difficult task that is attempted to be carried out in this paper is to provide a synthesis of many of the different case studies that appear presented in the literature, a difficulty that stems from the fact that many of these present case studies carried out following participatory and constructivist evaluation approaches. Constructivist paradigms are an important tradition in education. A problem that they present for evaluation is that they present findings and conclusions that are only valid for the local sites in which they were produced and their immediate context, subject to alternative meanings based on their participants (Weiss, 1998: 29). Participatory evaluations involve the use of formative evaluation and other types of assessments that are carried out to involve both the staff and stakeholders of a program or project in the process, providing a forum for the use of such information in the management of the program or project. Weiss has pointed out that in many cases these types of approaches however fail to involve the stakeholders and the studies present limitations due to the fact that the staff of a program tend to be quite conservative in regards to the type of problems that they take into account (Weiss, 1998: 31).

In consequence, there are different types of groups that can be distinguished:

. Articles that present the cases of education partnerships that have been implemented, written by

evaluators that have been involved in their development.

. Articles that provide with a review of different partnership experiences and articles with the aim of identifying those common factors that make this type of initiatives effective. Since the audience of these set of articles are not only academics but also practitioners, the focus is mostly set *on* providing recommendation and lessons from practice.

The knowledge claims of the articles considered varies enormously, since this literature does not include only articles grounded in research projects or evaluation of cases, but also articles written by practitioners for a practitioner audience and more oriented towards the divulgation of particular practices.

Reviewing the literature in regards to the conceptualization of partnerships would still allow generalizing findings and contributing to a better understanding of them. It would still be possible to generalize findings to theory if there were a common definition of these partnerships, yet these are conceptualized quite differently across the literature: as a process, a venue *or* as a program. This difficulty is reinforced by a theme that appears commonly mentioned in almost all of the different experiences and that is that there is not one single definition of a partnership or strategy for its success. It is reasonable that there would be not one model of partnership that would be applicable to all type of contexts across the country and different goals.

Studies evaluating the outcomes of these activities are relatively more recent. Wiseman and Knight (2003) edited a volume synthesizing some of the main studies carried out following different type of research designs and approaches. More recently, a volume in the journal *New Directions for Evaluation* was devoted to articles presenting different approaches to STEM evaluation and education.

In the public sector, partnerships and contracting out have become important forms of delivery of public services. While fundamentally different -in the first the public sector retains an active role in the delivery of the service, while in the latter this corresponds to a third party- they both entail a redefinition of the role of the public agency in question.

In the area of R&D, the emergence of a cooperative technology paradigm (Bozeman and Crow, 1998) has been observed since the 1980s, characterized by the goal of improving the cooperation of different sectors and actors in regards to the funding and carrying out of R&D and technology commercialization. This paradigm entailed a policy rationale that largely assumed that the coordination of resources and efforts across different sectors for mission oriented R&D.

3.3 Partnerships as an inter-organizational form

Partnerships entail the joining up of resources and a tendency to centralizing efforts, and can be considered in this regards as part of an effort to improve the coordination of the activities of different actors towards a common policy goal. Cooperation, collaboration and synergy are terms that appear used to describe the nature of such endeavors. From this standpoint they present with similar features to some of the new types of organizational forms observed in private organizations such as consortia, strategic alliances, and joint ventures.

From an organizational perspective, partnerships as an inter-organizational form in the public sector could be considered in terms of the broader discussion on market and hierarchies. While market type of organization rely on a high level of autonomy at individual level, the hierarchical organization is characterized by an organization with a centralized authority and it’s most typical example is bureaucracy. Partnerships can be considered as an inter-organizational form that establishes a "horizontal" type of arrangement among organizations, in contrast to a

hierarchical one.

The hypothesis posed by Kingsley's research project poses that *"partnerships formed on the basis of positive embedded relationships and matched by congruence of complementarity of strategic needs among the partners are likely to develop more harmonious and efficient partnerships that will be more effective in achieving process and performance outcomes"* (page 3 of the project proposal).

"Embeddedness describes the number and types of relationships that organizations have with one another prior to the development of partnerships" (page 2 of the project proposal). The aforementioned concept stresses the importance of the context in which the participating organizations are set, and the types of relationships they have with other organizations. This hypothesis implies a social model of organizational behavior in which the social context, networks and the actors' positions in them are causal explanations (Pfeffer, 1997: 55). The concept of embeddedness entails a model of the individual that is neither atomistic nor oversocialized, but situated in the context of interrelations with other individuals.

The more widespread application of Granovetter's concept of embeddedness has been his conceptualization of the strong and weak ties among actors as a very effective channel for the sharing and flow of information. In regards to economic behavior and the organizations of firms, this author observes that such relationships can be a very effective: *"long-term relations of contractors and subcontractors, as well as the embeddedness of those relations in a community of construction personnel, generate standards of expected behavior that not only obviate the need for but are superior to formal authority relations in discouraging malfeasance"* (1985: 498). Trust built through interaction among individuals is an important informal mechanism for social cohesion. The concept of embeddedness points out to considering the dimension of non

formal interrelations among individuals. These include not only their organizational affiliation but also professional and personal acquaintances, such as those ties that ties based that come from participating in professional associations and other activities.

While the argument on market versus hierarchy stresses the relevance of transaction costs for the development of either hierarchical or more horizontal types of organizational arrangements, Granovetter's conceptualization observes the importance of interactions and interrelations among individuals as the main source of information exchange and trust building: the *"embeddedness argument stresses the role of concrete personal relations and structures (or 'networks* ') *in generating trust and discouraging malfeasance"* (Granovetter, 1985: 490).

Embedded ties lead to higher a degree of trustworthiness, which eases both the setting up of processes for the monitoring of compliance, as well as incentives and sanctions. Strong ties characterize those individuals that often interact, and have been found to be very effective for social control and cohesion, as well as the sharing of tacit knowledge. In a study of firms, Uzzi found that these types of ties are more effective at "conveying complex, context-dependent knowledge" (Powell and Grodall, 2005: 72). Weak ties have been found to be often the sources through which novel information is acquired, which have been found to be important not only for individual's career choices, but also firm strategy and innovation (Granovetter, 1995; Powell and Grodall, 2005).

Another reconsideration of the market versus hierarchies argument was developed by Stinchcombe (1990) in his analysis of organizations in terms of their information structures. Considering that the core structures of organizations are devoted to reducing external and internal information uncertainty, the author finds that organizational structures tend to grow towards those locations where information for resolving uncertainty is chiefly located.

Stinchcombe's notion of extended hierarchical forms such as those embodied in contracts, provides with an important concept for the consideration of how activities within school-university partnerships are organized and managed, as well as between partnerships and the funding agencies. The five elements of his notion of extended hierarchy are labor contracts, fiduciary relations, legal procedures, governance and meetings (Stinchcombe, 1990: 194). It is interesting to note that the latter two elements appear mentioned very frequently in the literature on partnerships.

3.4 Partnerships, collaboration and networks in R&D activities

Numerous studies in S&T Policy and Social Studies of Science have demonstrated patterns of collaboration among individuals that are not based on face to face interactions or even acquaintance but grounded on the type of work. Emergent networks grow out of ongoing relationships, and such type of collaborations and organization formals characterize the dynamics of collaboration among scientists. Invisible colleges that emerge out of a shared experience or common interest are the most important type of this kind found in the literature on S&T (Powell and Grodal, 2005: 63). It has been found that many R&D partnerships in the life sciences have emerged from strong ties such as co-authors, mentor-mentee relationships as well as common training (Powell and Grodal, op.cit.).

It is also interesting to note the tendency towards funding research consortia and grants that compel different research groups to work together. Powell and Grodal (2005: 61) note that most of the literature on interfirm networks extrapolates findings from interpersonal collaborations, and that the question on the extent on which interorganizational ties are

contingent upon the latter is still an area of further research.

Rogers and Bozeman (2001) have elaborated the concepts of knowledge value collectives (KVC) and knowledge value alliances (KVA) which that allow to better apprehend and distinguish among informal and formal networks of individuals and organizations tied by the uses and flows of information. A knowledge value collective is "*a set of individuals connected by their uses of a particular body of information for a particular type of application – the creation of knowledge (defined in terms of new uses of information)*" (2001: 26). It involves producers and users of knowledge pursuing a common interest given by the creation of knowledge, but to diverse ends (op.cit.). A knowledge value alliance is "*an institutional framework binding together in a 'knowledge covenant' a set of directly interacting individuals from multiple institutions each contributing resources in pursuit of a transcendent knowledge goal*" and usually becomes active with a formal agreement (Rogers and Bozeman, 2001: 28). These involve actors from different institutions, are usually initiative by formal agreements or instruments such as grants, have an organizational style that is generally nonhierarchical, and involve multiple incentives that may or not be aligned since they are focused on multiple uses of knowledge and may involve multiple KVCs (Rogers and Bozeman, 32-33).

It is not easy to extrapolate these findings to the context of MSP partnerships because they involve not only different types of actors, but also a different type of work. Scientists from STEM fields engaging in such activities are carrying out a particular type of outreach or divulgation activity.

3.5 Education literature

The Department of Education has fostered the creation of educational partnerships since 1989 (Tushnet, 1993: 7) when the Office of Educational Research and Improvement's program funded programs to improve elementary and high school education in a variety of areas *("curriculum reform, school to work transition, coordinated social services, and systemic change"* (Tushnet, op.cit)). That first program funded the establishment of partnerships among school districts and so varied actors as higher education institutions, non profit agencies and business consortia. In a guidebook developed on the basis of the review of the experiences funded under this program, Tushnet concludes that there is *"no single way to ensure successful partnership development"* (1993: 9).

The current MSP program funded by this agency presents some important differences with the one established previously by the NSF. The NSF MSP program provides funding on a “non compelling basis”, that is funding is provided for the development of an activity in the same way as it is provided for traditional research grants. The MSP program carried out through the Department of Education provides funds in the form of matching grants that require that State governments also provide funds for the projects. Both grants and matching grants are a different form of contracts for the outsourcing of government activities.

There are different types of partnerships in education: partnerships among schools and universities; partnerships among schools, universities and local communities; partnerships among schools and private firms or corporations. For example, Fendler (2003) carried out a study on a partnership among the Education department of a university with public schools, local government and community, businesses to establish professional development schools. The author analyzed the initiative as a reconfiguration of two strong tendencies in education reform:

towards centralization as implied in the initiatives for state-mandated curricula, standardized testing and state-distributed funding; and towards decentralization as in charter school programs, voucher plans and site-based management (2003: 189).

Research on teacher professionalization has provided with many concepts and findings for the formation of professional development schools. This literature has provided with many findings and recommendations for the establishment of professional development as an integral part of the teacher profession in a path of career-long continuum in which training does not finish after the initial certification.

Besides the programs established under the NDEA described in the introduction, an important precedent are school-university partnerships established during the 1980s such as the National Network for Education Renewal (NNER) which involved activities that aimed at simultaneously reforming schools and universities. These partnerships were established among school districts, schools and universities guided not only by values of educational equity and excellence, and collaborative inquiry (Sirotnik, 1988: 181) but also instructional, curricular and organizational improvements in schools and schools of education (Goodlad, 1988: 21). This type of partnerships proposed the need for different types of assessment than the ones grounded solely in considering the impact on student performance.

The development of a common vision, shared goals, responsibilities and roles are noted as crucial for the successful formation of a partnership since they provide with a common definition and ground for the different participants, as well as overcoming differences between school and university organizational cultures (Abma, Fischetti, Larson, 1999: 333). Most of the articles in the education literature -and articles on different types of partnerships- note that for this process develops successfully with extensive communication and time.

Important influences on this literature are articles grounded in constructivist approaches to education, as well as action-research and participatory approaches. Some evaluations of school-university partnerships follow formative evaluation designs with a participatory research design. These types of evaluations have been used as another tool for the management and development of the partnerships themselves yielding information on a timely basis both to partners and stakeholders (Osguthorpe, 1996; Borthwick, 1995 and 1999; among many others). These types of approaches have been recently described as part of the methodological pluralism that characterizes the current state of STEM evaluation (Lawrenz and Huffman, 2006).

An important approach can be considered among those articles that attempt to present the participant's -students, teachers, administrators and faculty- perceptions and experiences with these types of partnerships. Many of the "praxis" articles can be considered under this third approach. Several articles on partnerships that have been sustained for long periods of time present this type of standpoint Abma, Fischetti and Larson (1999) present the account *of* both school administrators and faculty on how a Professional Development School has been sustained for ten years among a high-school and a university in Kentucky. Borthwick et.al (1995) reconstructed the perceptions of the participants of partnerships and find that the meaning that it has for them and compares it to conceptualizations that stem from organizational and interorganizational literature. In a guide to developing partnerships funded by the OERI, Tushnet (1993) defined partnerships in terms of a process and focused on long-term goals.

Yet praxis literature is not the only type of literature that has addressed this topic. Studies following qualitative methodological approaches have been carried out to consider the perceptions of partnership participants (faculty, teachers and students) on the factors considered as crucial for successful school-university partnerships for school improvement (Borthwick

et.al., 1999; Teitel, *2003*). Studies that have sought to gather the student's perceptions (school students, not teacher candidates) on these types of education reform initiatives are less frequent but have also been considered as an input for enhancing the effectiveness of these types of teacher preparation practices (Cowart and Rademacher, 2001*;* Borthwick et.al., 1999).

It has been observed that both schools and universities present very particular type of organizational cultures. The difference among university's and school's cultures appears frequently mentioned in the literature. In fact many of the common themes related to the development of successful partnerships can be considered as attempts to bridging these differences. In many cases these appears as a role ascribed to leadership of different type: distributed and transformative leadership, building of professional communities; or more particularly building common philosophical bases and shared goals.

3.5.1 Trust, communication and time

On this topic the education literature can provide many insights since many studies focus on the perceptions of the participants in partnerships. The praxis oriented literature poses that the establishment of adequate communication patterns is crucial for the success of partnerships, but highlights the different types of organizational cultures in providing the opportunities and constraints for these to be set.

Trust might be considered as an implied notion in the frequent postulation found in the articles that considerable periods of time are needed for the partnership development a theme that appears consistently across the different types of articles and different types of partnerships. In contrast to the organizational literature, here the consideration of trust appears as a crucial determinant for both the initial building of a common vision and goals, as well as the adequate

resolution of conflicts that may emerge throughout the development of the partnership. Tschannen-Moran notes trust as a necessary element for successful education reform because "new forms of governance such as site based management, collaborative decision-making and teacher empowerment depend upon trust" (2000: 585) and find evidence in the literature on the influence of trust for improving student's achievement and organizational performance of schools.

Brinkerhoff (2002) proposes a framework for the evaluation of different types of partnerships across several domains- defined as voluntary, linked to shared values, based on either the character or the competence of participating individuals and organizations.

In the more practitioner type of literature, the notion appears related to other aspects that arise in the management of partnerships. Clark (1999: 168) considers that to develop trust "extensive dialogue about substantive matters of mutual concern and accomplishment of specific goals". The latter is perhaps the most common theme in the literature: communication and dialogue among the partnering organizations is needed to develop trust which appears as a precondition for the setting up of a shared vision and goals.

A common theme that emerges from the Education literature is the attribution of an important role to leaders for the successful formation and operations of a partnership. Different types of leaders can be distinguished: those that initiate the partnership, leaders from each participating organization, and boundary spanners.

An important theme that emerges in this literature is the role of leadership for the formation and development of partnerships. Different articles address the need of leaders that would facilitate communication for the development of common goals and achieve cultural

change, broker among different interests and allow for the resolution of conflicts and tensions. Leadership is considered in terms of boundary spanners and champions, which resembles the conceptualization of policy entrepreneurs and brokers in many policy studies frameworks.

In a longitudinal case study of a school-university partnership, Firestone and Fisler (2004) considered the concepts of professional community, distributed leadership and micropolitics to understand the dynamic of the partnership. From a different approach than the aforementioned, this study attributes to leadership the possibility of *"bringing about professional communities in politicized situations"* (2004: 451) coordinating different sources of influence and leadership without imposing a strong centralized leadership. This author applies the concept of micropolitics to consider the differences in culture between schools and universities. Overall, both approaches consider the role of school leadership for an effective adaptation to reform efforts, and emphasize aspects related to the creation of leadership and a sense of community among school teachers and administrator.

CHAPTER 4: Analysis of expert panel survey

Data from the opinion scale questions was analyzed by simple descriptive statistics and cross-tabulations. Because the total amount of the respondents is small (32), modal responses were considered. Also, missing responses as well as "no opinion" responses were not replaced or recategorized, but on the contrary were considered as an important indication of the reliability of the items[4].

A goal was to develop two different models of partnership operations phase as influenced by pre-conditions of strategic alignment and embedded relationships by the respondent's policy orientation. Yet it was not possible to categorize the respondents into two broad groups that would present a consistently different orientation towards the importance of these pre-conditions for the operation phase. Although this is very discouraging, it is to some extent consistent with the literature that repeatedly described that there is not one model of partnership.

4.1 Description of the respondents

Of the 32 experts included in the panel, two did not complete two rounds, and another one did not complete one round.

[4] e.g., when the amount of respondents that answered "no opinion" was larger than three, it was considered for the present analyisis that this was an indication of problems with the construct validity (the respondents did not understand the question), and in consequence these items were not considered for the analysis even if they were measuring some of the variables considered here.

The respondents are from nineteen different states. Eighteen are men and fourteen women. Twenty five respondents were more than 50 years old at the time of the survey, three between 40 and 49 years old, and four between 30 and 39. Twenty-one hold a PhD degree and eleven a MA or MSc degree. The major field of ten respondents is science, mathematics for other seven, social science for other four, and eleven from education.

The respondents had all long experience in partnerships; all of them had held more than three different types of job positions in these types of activities, although as much as seven respondents had less than five years of experience working in the STEM field. Twenty-six respondents reported that they had founded a partnership Eighteen respondents are affiliated with universities, four with K-12 institutions, and ten with other type of organizations. Seventeen have experience in teaching.

4.2 Research questions and hypothesis

The hypothesis considered here is that embedded relationships among individuals and organizations involved in partnerships have a positive effect on the operations phase. Embedded relationships among individuals are an important source of trust, and this is an effective source of control, easing coordination of activities and compliance with responsibilities.

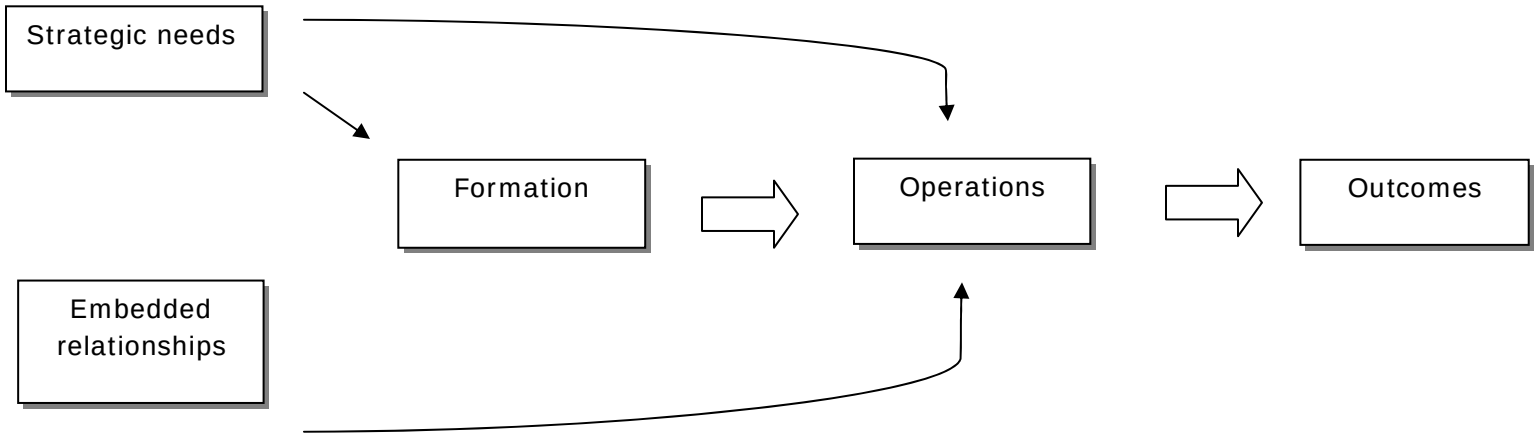
Although the expert panel does not provide information on the ties of the individuals, indications of this could be gathered from open-ended questions that asked them to describe their experiences in partnering. Here a more conservative measure will be considered: their work experience. The longer the work experience of the respondents in their areas as well as in partnerships, the more strong and weak ties they probably have. Three variables give indication

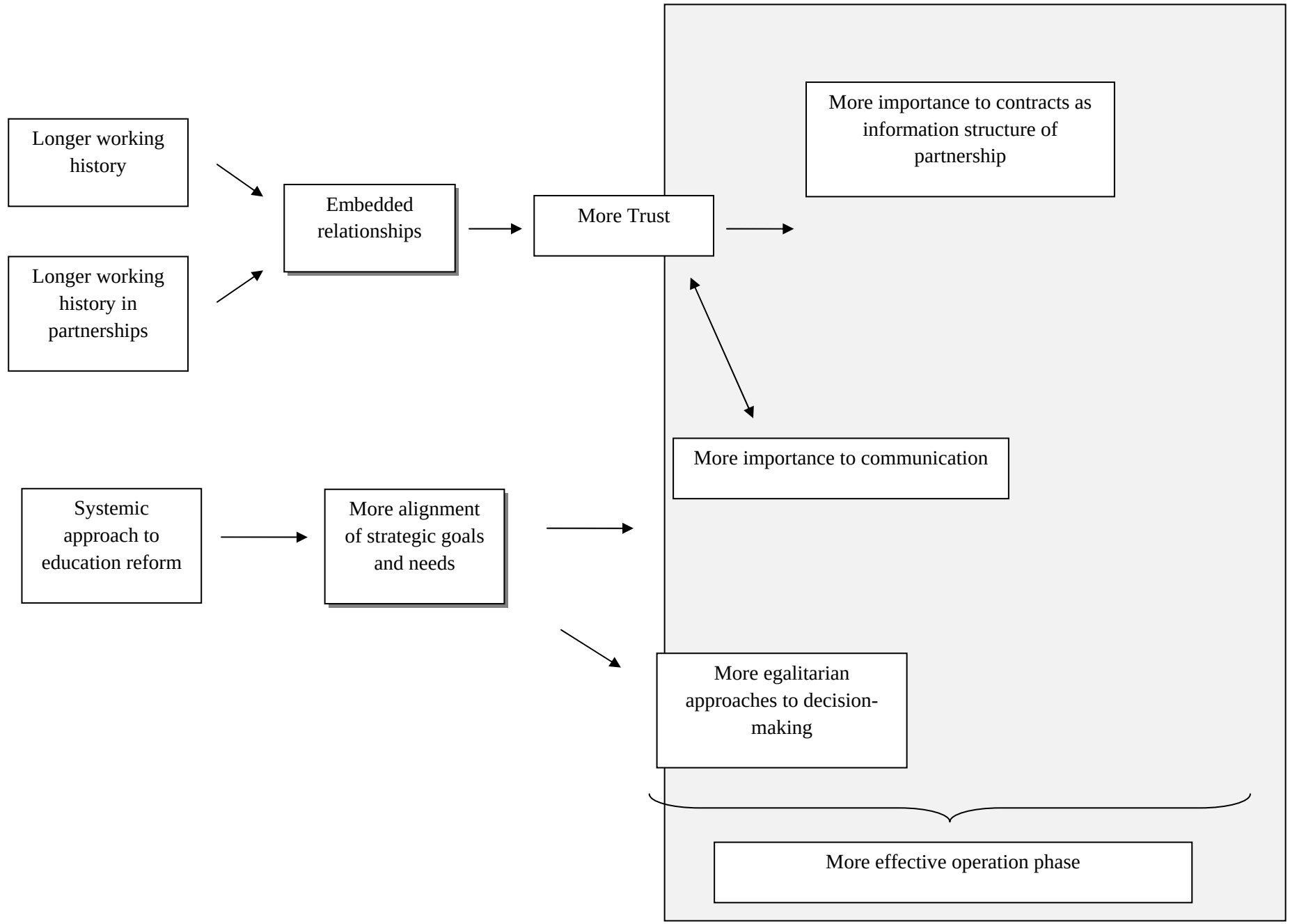
of this: “experience in STEM field” as well as “experience teaching” are approximate measure for the work experience of most respondents; while the types and amount of job positions they have held in partnerships is considered as an approximate measure of their work experience in partnerships. Although the panel was composed by individuals who had an important working experience in partnerships, some did not have a long experience in the STEM area or teaching.

The second hypothesis considered aims at considering an aspect related to the policy orientation of the individuals. Individuals with a more systemic orientation towards education reform, consider that not only improved teacher preparation and student achievement are important goals of partnerships but also building organizational capacity and reforming the current approaches of each institution to teacher preparation. More precisely, they will give more importance to communication and contracts in the operations phase, as well as present a more egalitarian orientation towards decision-making. Most of the respondents considered that the partnerships in which they had participated had a “holistic approach” to education reform (round 4, question 4). Considering the Statewide Systemic Initiatives program of the NSF, a new variable was built from the responses to three open-ended questions categorizing the respondents into those who presented an orientation more aligned with that program’s rationale. The aim was to consider this as a new independent variable in the analysis of cross-tabulations of responses, with the hope that it would provide with a useful measure for constructing one dimension of a broader typology.

The logic model that is considered here is the following:

Figure 2. Logic model – adapted from Kingsley and O'Neil (2004) and Kingsley and Washchak (2006)




Longer working history
Longer working history in partnerships
Embedded relationships
More Trust
More importance to contracts as information structure of partnership
More importance to communication
Systemic approach to education reform
More alignment of strategic goals and needs
More egalitarian approaches to decision-making
More effective operation phase

The first hypothesis can be considered as derived from the original hypothesis of this project, while the second one is derived from the literature.

To consider the second hypothesis, a variable was built in the attempt to categorize those respondents that presented an approach towards systemic reform efforts draw on responses from the following questions in round 1: question 12 that asked the respondents to mention their experiences in partnering; questions 13, 14, and 15 that asked the respondents to describe their best partnership experience, and question 25 that asked about their negative experiences in partnering. While the first one can be considered as a type of status question, in contrast to an opinion question; the latter are clearly questions that ask about a normative and value judgment.

Respondents were categorized as holding a policy belief of systemic reform if they mentioned explicitly systemic initiatives. Only six (6) respondents mentioned this type of partnership as the best partnership in which they had participated, while as many as eighteen (18) mentioned working experience in them. An examination of all the open-ended question showed that those that did not mention these type of partnerships as the best ones in which they had participated, they did draw explicitly from experiences in them to answer other questions. All 18 respondents were categorized as holding a systemic reform policy orientation.

Most of the respondents affiliated with universities or K-12 school districts fell into this category, in contrast to those affiliated with other type of organizations: 14 respondents affiliated with universities, 3 with K-12 level institutions, and only one affiliated with other organizations (all tables are included in the appendix).

4.3 Descriptive analysis

A set of three items in the first round of the survey panel lead to the most significant results in the whole four rounds. These questions gathered the opinions on how power or authority should be vested in the formation and operation phases of a partnership. Six (6) respondents present an “egalitarian” type of notion of how authority is to be distributed during the formation and operation phase. These respondents strongly disagreed with the statement that power should be vested in one individual or one organization; and strongly agreed with the statement that power should be equally shared during these two phases.

These six respondents are all women. Three of them are affiliated with a university and have founded partnerships. Other two are affiliated with another type of organizations and one with a K-12 institution. Three of them are White, one is Native American, one African American and one Hispanic. Their experience in STEM field range from 0 to 35 years.

This group was identified by considering their responses in the three set of items of this question. A consideration of the overall distribution by gender confirms this, since women were the only to present a polarized negative response to questions 18a and b: more than half of the women (7) strongly disagreed that power should be vested in one individual during partnership formation, and almost half (5) strongly disagreed that it should be vested in one organization (all tables are included in the appendix).

Table 3. Distribution of responses to question 18a Power was vested in one individual during formation and operation (round 1) by gender

	Men	Women	Total
Agree/Strongly agree	10	3	13
Neither	4	0	4
Disagree/Strongly disagree	3	9	12
No opinion	1	0	1
Total	18	12	30*

*Two missing responses, both women

In this table a strong association by gender can be observed, and it is significant at the 0.5 level. In fact, this is the strongest association found in all the responses by any type of respondent attribute.

Table 4. Distribution of responses to question 18b "Power was vested in one organization during formation and operation" (round 1) by gender

	Men	Women	Total
Agree/Strongly agree	12	5	17
Neither	3	0	3
Disagree/Strongly disagree	3	7	10
Total	18	12	30*

*Two missing responses, both women

Table 5. Distribution of responses to question 18c "Power was shared equally during formation and operation" (round 1) by gender

	Men	Women	Total
Agree/Strongly agree	7	9	16
Neither	1	1	2
Disagree/Strongly disagree	9	2	11
No opinion	1	0	1
Total	18	12	30*

*Two missing responses, both women

Although many men and women agreed with this statement, half of the men also disagreed. Although the results of this table are less confirmatory, the consideration with the responses to the previous two items does allow characterizing women as presenting a more egalitarian orientation towards how power or authority should be set. While almost half of the women agreed that power should be vested in one organization, three-fourths agreed that it should be shared equally.

Moreover, these orientation is also consistent with the responses in round 2, in which almost all women disagreed with the statement that partnerships are more effective when a single individual is in charge of decision-making (question 12f). Although an important proportion of men also disagreed with the statement, the fact that 12 out of 14 women did give more importance to the findings from round 1.

Table 6. Distribution of responses to question 3d "As a reviewer I think it is likely that one organization will control all partnership activities" (round 3) by gender

	Men	Women	Total
Agree/Strongly agree	5	1	6
Neither	4	1	5
Disagree/Strongly disagree	8	12	20
Total	17	14	31

*One missing response.

Considering the responses in these four items, two other groups can be distinguished. Five (5) respondents presented the counter orientation to what I am denominated an "egalitarian" tendency observed in female respondents. In contrast to that group, this small group of five respondents agreed or strongly agreed with the statements that power should be vested in one

individual or one organization during the formation and operation phases, and strongly disagreed with the statement that it should be shared equally. These five respondents are all men and affiliated with universities.

Finally, another four respondents consider that power should be vested in one organization, and disagreed with the statements that it should be vested in one individual or shared equally among organizations. These four respondents are also all men; two are affiliated with universities while the other two belong to other type of organizations.

Only gender showed to be associated with the responses to these question, tables in the appendix show that neither organizational affiliation nor systemic orientation nor the major knowledge field present association patterns here, nor there exists a spurious relationship, all of which is an important further disconfirmation of the second hypothesis.

In a simple cross tabulation analysis, the new variable on systemic reform policy orientation presented significant results only in some few cases. More importantly, it did not yield any association pattern in the three questions that considered how power or authority should be held in a partnership (round 1, questions 18a, b and c), and in consequence a systemic reform orientation is not associated with more egalitarian approach. Respondents in this category did not present any particular orientation to how power should be vested in partnerships, if in one individual, one organization or shared equally among the partnering organizations. In regards to the latter, while nine respondents agreed or strongly agreed with that statement, another seven disagreed. Table .. in the appendix shows that there were no association between this orientation and answers to the items 18a, b and c in round 1.

In the last round of the expert panel, this group of respondents mentioned that in their experience partnership had an impact on the capacity of their home organizations (question 9j and 9k), both in regards to organizational changes (questions 9i and 9j).

The variable also showed some significant in regards to some of the opinions that respondents gave when asked to evaluate two partnership scenarios. When asked to evaluate the first scenario of a partnership for science education, these respondents considered that it was likely that one organization would control all activities (question 3d), and only of them would approve the project (question 6k).

Table 7. ***Distribution of responses to question 3d "As a reviewer I think it is likely that one organization will control all partnership activities" by systemic policy reform orientation***

	Other	Systemic	Total
Agree/Strongly agree	0	9	9
Neither	9	4	13
Disagree/Strongly disagree	4	2	6
No opinion	1	2	3
Total	14	17	31*

*One missing response

Table 8. Distribution of responses to question 6k "As a reviewer I would approve funding for this project" (round 3) by systemic reform policy orientation

	Other	Systemic	Total
Agree/Strongly agree	6	1	7
Neither	2	1	3
Disagree/Strongly disagree	6	13	19
No opinion	0	2	2
Total	14	17	31*

Although in general most respondents presented concerns about the successful formation of this partnership, relatively more respondents categorized as pro-systemic disapproved.

When asked to evaluate the second scenario about a partnership for mathematics education in a school district attended by students from poor and minority backgrounds, these group of respondents agreed that the organizations involved would be likely to change their internal operations due to the partnership (question 13e).

Table 9. Distribution of responses to question 13e "As a reviewer I think it is likely that the partner organizations will transform their own internal operations due to exposure to the activities outlined in this scenario" (round 3) by systemic reform policy orientation.

	Other	Systemic	Total
Agree/Strongly agree	6	11	17
Neither	5	0	5
Disagree/Strongly disagree	2	6	8
No opinion	1	0	1
Total	14	17	31*

Although not statistically significant, it is telling that so many of the systemic respondents considered that the partnership would be impacted by external factors out of their control (table included in the appendix). Also, most of these respondents would approve the project, although the same distribution is observed in the set of respondents not categorized under this orientation (table included in the appendix).

An explanation for their different consideration of both scenarios might be precisely the experience of many of these respondents in Urban Systemic Initiatives were funded for localized reform efforts in areas that were especially school attended by students from disadvantaged backgrounds, and the description of the scenario was more similar to the type of partnerships in

which they had participated. While this does not lead to particularly new insights, it does serve to confirm the policy orientation of this group of respondents.

Formal agreements, memorandums of understanding, and contracts

In the first round of the expert panel, most respondent did not consider legal contracts as a very important factor for the development of a successful partnership. There were five respondents that gave no opinion in this item, and one missing response which relatively to the total amount of responses is a high number and might be pointing out to problems with the construct validity of this item –for example, "legal contracts" might be a too broad notion for the respondents to understand to which type of legal contracts it is referring to.

Eleven (11) respondents considered that legal contracts were somewhat important and had no effect, while other seven (7) assigned them a neutral value of importance (table included in the appendix). Two respondents considered that they had a negative effect. Only one fourth of the respondents considered them with high levels of importance.

Table 10. Distribution of responses to question 7a.6 "How important are legal contracts to the formation of a successful partnership?"

	f
Critical	2
Very important	4
Important	7
Somewhat important	7
No effect	4
Negative effect	2
No opinion	5
Missing response	1
Total	*32*

In regards to activities for partnership formation, other items were considered as more important by most of the respondents. The modal responses for high levels of importance were

observed in regards to administrative support, full-time staff as well as regular meetings were considered as critical or very important. Increasing institutional support and timely payment of invoices were also considered as important factors (table included in the appendix). It is quite surprising that timely payment of invoices was considered with high levels of importance by almost three times more of respondents (17) than those that considered legal contracts as very important (6).

Question 21 asked the respondents to consider the importance of "*contracting all work legally*" in regards to the accountability and structure of a partnership. As many as thirteen (13) respondents disagreed with the statement, and only ten (10) agreed. Two modes were observed, among those that strongly disagreed and those that agreed (8). Again, four respondents gave no opinion on this item, and there were two missing responses, which may be reinforcing the concerns about construct reliability observed in question 7a described above.

In question 21 the items considered most respondents agreed with the statements that all the work carried out by the respondent's organization and other organizations was carried out as agreed, and that top level management solicited information from all levels.

4.4 Analysis of the open-ended questions

An open-ended question in the second survey round of the expert panel, asked if the respondents considered if they found in their experience "*useful to have a formal agreement in the form of a contract or memorandum of understanding that binds the partners to a course of action*" (question 18). Twenty-seven (27) respondents answered this question, and the following table provides a summary table of the main themes. The table also shows the responses

categorized by the two variables that were developed as attributes of the respondents: the systemic policy orientation, as well as the egalitarian approaches to partnership management in question 18 a, b and c. The many different themes that emerge from these responses make it that the question did not differentiate between memorandums of understanding and contracts, since some of the responses consider the role of such documents in the planning and monitoring of activities, while others consider it's role for the assignment of responsibilities and accountability.

Figure 3. Summary table of themes in open-ended question 18 "In your experience, is it useful to have a formal agreement in the form of a contract or memorandum of understanding that binds the partners to a course of action?" (round 2), by systemic policy orientation as well as orientation towards authority in partnerships

		(responses from question R1 18a, b and c)			
	Systemic	Egalitarian orientation towards authority in partnership	Authority centralized in one individual	Authority centralized in one organization	Respondents that do not fall under any of that categories
Financial accountability – allocation and use of funds	• • •	• • •			• •
Useful as initial goals, activities and responsibilities, but need to allow for reformulation in further time	• • •	• •			•
Organization of work, assignment of responsibilities	• • •	•			• •
Trust and communication are more effective for compliance	• •		• •	•	
Compliance	•		•		• •
Setting of mission and goals	• • •			•	•

Five respondents mentioned that these types of agreements were useful for the purposes of financial accountability, as guidelines for the allocation and use of funds (d172005, d232005,

d492005, d582005, d932005). One respondent considered that they were not useful in his/her experience (d522005). Five observed that they were useful for setting up the goals and activities to be carried out but that they should remain open enough to allow for reformulation throughout the partnership activities. Four respondents noted that they were useful as a mechanism for conflict resolution.

Most interestingly, six respondents considered these type of agreements in terms of mechanisms for ensuring compliance with the assigned responsibilities and compared them with non formal type of mechanisms such as informal agreements, trust based on previous working history and communication. Three of these respondents had been categorized as presenting a systemic reform orientation. These six respondents explicitly compared in their responses formal agreements such as contracts and memorandums of understanding with other type of informal mechanism for ensuring compliance.

Two of these respondents considered that a "*handshake*" (d532005) or "*informal agreements*" (d782005) all that is needed to carry out the activities at the operational level. Another respondent considered that formal agreements and/or contracts are useful for new partnerships in which there is no previous working history, but "*in the case of an established partnership pursuing a continuation project, it may not matter*" (d612005). Respondents d592005 and d332005 considered that formal agreements were detrimental when used for punitive purposes. In the case of new partnerships with no previous working history *"if a formal agreement is enacted because there is an initial lack of trust that the participants will fulfill their commitments, then it is not helpful"* (d592005) - compliance with the responsibilities is to be achieved by maintaining clarity about the goals and tasks through communication. Respondent d332005 noted that "*if the contracts were used in a punitive or overwhelmingly binding sense, it*

seemed to give a sense of "policing" one another's actions, as opposed to learning from our work. In most cases, when folks don't meet their obligations it has less to do with intentional noncompliance, than changing circumstances or unforeseen obstacles. So, we use the contracts as a way to discuss what did we say we'd do, what did we actually do, and what can we learn from that and therefore how do we modify the agreement for the next time period. They really need to be in the spirit of setting some goals and learning, not just for accountability". Finally, a fifth respondent (d442005) pointed out that he/she found these type of agreements in general not very useful except for administrative purposes, and noted that in his experience because they had begun partnership activities before a formal agreement was in place they had have rarely bad experiences.

All of these five responses compare the effectiveness of formal and informal agreements as mechanisms for assuring compliance with the carrying out of a particular set of activities. Two respondents considered in particular the notion of trust, and while one considered that formal agreements are useful in cases in which there is no previous working history and trust among the partners (d612005), the other considered that this is not effective in such cases and instead communication is more useful for achieving compliance (d592005) and easier coordination of activities. Yet both considered the role of formal agreements such as contracts and memorandums of understanding as ways of reducing the uncertainty about compliance as compared to non formal such as trust built by previous working history and communication.

In contrast, five (5) other respondents considered formal agreements as very useful as mechanisms for ensuring compliance. Three respondents mentioned explicitly them as mechanisms for solving conflicts or problems, as "*an external criterion to consider whenever there are conflicts in the partnership*" (d362005) or "*helpful and necessary.. in the event there is*

disagreement at some later date" (d412005). The third respondent mentioned that the partnership in which he/she participated was redefining their original formal agreements after "not getting cooperation in some areas" (d972005). While these three responses consider the role of formal agreements as an authority mechanism within the partnership, two other respondents pointed out that they had been helpful to "*help individuals battle their own administration*" (d982005), "*hold our own organizations to the agreement when situations arose where there was pressure to do something different - not approve funds for staff development, make staffing adjustments that would hurt the program, etc*." (d832005).

Four respondents considered as problematic the degree of specification that such formal agreements should have, noting they should allow for reformulation and adaptation to particular circumstances that may arise in particular contexts or over time throughout the partnering activities. Three of these respondents had been categorized under the systemic policy approach. "*..we have found that the work needs to be somewhat fluid. We have had to modify as we became more clear of the working environment and challenges in implementation. If we were tied to a rigid course of action, we would be hamstrung to truly do the work needed*" (d372005). Respondent d332005 noted the tension involved in the degree of specification of the stipulations: "*This is highly variable. For some institutions any ambiguity is unsettling and a contract helps them feel clear and comfortable about expectations. For some, a contract feels too 'binding' and doesn't allow the flexibility based on context and circumstance. In our work contracts at times were too 'generic' and so it didn't really honor the fact that implementation at each partner site was slightly varied so the generic contract caused some damage because it didn't clearly and specifically define their unique requirements.*".

The latter respondent as well as other four (d772005, d832005, d952005) noted the role of formal agreements for setting the goals and purposes of the partnership, and instrument of establishing commitment to its activities in a similar way that a strategic plan and definition of a mission do.

In these responses, there were no particular differences in the types of responses given by respondents categorized under the more egalitarian approach to partnership management, those that gave more importance to the leadership of one organization or those that gave it to one individual. Two out of the six respondents categorized as presenting a more egalitarian orientation towards the setting up of authority in partnerships, considered formal agreements and contracts in their role of financial accountability. Two out of the four respondents that had considered that authority in a partnership should be centralized in one individual were among the six respondents that compared the effectiveness of formal agreements and contracts to trust and informal agreements.

Those respondents that had been categorized as presenting a systemic reform policy orientation tended to mention the need to keep formal agreements and contracts open for reformulation during the partnership activities phase, as well as they constitute the majority of those group of respondents that compared this type of agreements to more informal ones. However, this is not enough to conclude that this group presents a particular recurrent opinion in regards to this topic.

Communication

Question 15 of the second round asked the respondents about their opinion on how communication practices can help and how they can hinder partnership activities. The responses to this question were quite extensive and numerous themes emerged. For the purposes of this paper a summary of the main themes was carried out in order to verify if the groups categorized under the systemic and egalitarian approaches respectively presented any particular pattern or more commonly mentioned themes. This also seemed relevant considering the importance given to communication for setting up a shared vision and goals in the education literature on partnerships, and more particularly to the emphasis given to this aspect by collaborative research approaches. The following table summarizes the main themes, and further disaggregation and refinement is possible to be carried out. For the purposes of this paper, however, it allows to consider the main broad themes that the respondents consider for communication activities in the operations phase of partnerships.

Figure 4. Summary table of themes in open-ended question 15 " In Round 1 panelists described the importance of mutual communication patterns amongst partner organizations. This was also listed as a major source of failure in STEM partnerships. Provide examples of how communication patterns can help or hinder a partnership in achieving goals" (round 2), by systemic policy orientation as well as orientation towards authority in partnerships

		(responses from question R1 18a, b and c)			
	Systemic	Egalitarian orientation towards authority in partnership	Authority centralized in one individual	Authority centralized in one organizatio n	Respondents that do not fall under any of that categories
Communication has important influence on carrying out activities and their impacts	• • •	• •	•		• •
Communication builds trust	•	•			•

Organization of communication an important aspect of partnership operations			• •	• •	•
Frequent communication	• • • • •				
Need of comm adapted to different audiences	• •				
Involving people in all decisions	•				
Keep everyone informed about changes	•			• •	• •

Type of activities to ensure communication:					
Regular meetings	• • • • •			•	•
Phone	• • •				
Email	• • •			•	•
Newsletter				•	•
Website				•	•

The second table presents a summary of the type of activities that were mentioned to carry out communication activities. Although the question did not ask the respondent to list this type of activities, many respondents differentiated among these activities mentioning that the use of e-mail, newsletters and web-sited had helped to assure communication at different levels of the partnering organizations (d812005); while others mentioned a preeminence of the use of face to face meetings, phone calls and e-mail which "*although sometimes that adds a time burden, it ensures we are in alignment*" (d372005).

CHAPTER 5: Conclusions

In the context of concerns about the programs for teacher preparation and professional development, MSPs may be providing with an important type of policy for not only improving this preparation but providing with more resources for schools, districts and universities to combine efforts and build capacity. The problem of a shortage of highly qualified math and science teachers is best understood when problems of the high rates of attrition of novice teachers and their mobility are taken into account. Public value failures of scarcity of providers and short-term horizons can be identified in some of the policy solutions that have been proposed to address this problem. The extent to which MSPs are successful in overcoming these cannot be considered here since the consideration of their outcomes as well as effectiveness is beyond the scope of this project, which has considered more particularly some aspects important for the operation phase of these types of partnerships.

The hypothesis about a policy orientation pro-systemic reform as having an influence over the respondent's opinions on the operations phase of partnership especially in regards to the governance structure, formal agreements and contracts was disconfirmed. The variable systemic reform policy orientation did not yield any significant or particular patterns in the opinion and open-ended questions. It did not polarize the responses, and this type of orientation only seemed to be associated with a few items that considered the judgment of the respondents on two

partnership projects, one of which presented common characteristics with Systemic Reform Initiatives programs sponsored by the NSF.

The most important association found between the attributes of the respondents and their opinions was gender. No significant associations were found considering the organizational affiliation, age or work experience. This further disconfirms the second hypothesis.

Gender differences appear significantly in regards to the setting up of authority in partnership formation and operations. Women presented a more egalitarian type of tendency since most of them agreed more with that power should be held equally by the different partnering organizations, and disagreed with statements on that it should be vested on one individual or one organization. In the second round of the survey, they also disagreed with the statement that for a partnership to be effective decision-making should be given to one individual. In contrast, a subgroup of almost one-third of the male respondents considered that power or authority should be vested in one organization, and another similar proportion that it should be vested in one individual.

In the open-ended questions considered here on the role of formal agreements and contracts as well as communication activities for partnership operations, no pattern was observed either by this more or less egalitarian responses, nor systemic reform orientation. Nonetheless, interesting themes emerged from the open-ended questions in consideration to the role of trust as an informal mechanism and formal agreements and contracts on the other hand for partnership operations. Five respondents compared the effectiveness of these mechanism to that of informal mechanism based on trust as basis for compliance with the plan of action, considering in general that the first are more effective in the operations phase.

Most respondents considered that communication activities were important for building goal alignment among the different partnering organizations. Communication was considered as having an important influence on how activities were carried out and in consequence on their outcomes and impacts. Most respondents considered that communication had to be frequent, and regular face to face meetings were mentioned most frequently as the type of activity for this purpose.

Although this does not prove the first hypothesis on a positive influence of embeddedness on partnership operations, it does present with strong indications about the importance of trust in the planning and carrying of activities as well as on the importance of communication for goal alignment and cohesion. The further consideration of other open-ended questions in the survey might provide more insights.

APPENDIX

Systemic reform policy orientation

Table 1: Distribution of respondents by organizational affiliation and systemic reform orientation

		Org Affiliation			
		University	K-12	other	Total
syst	not	4	1	9	14
	syst	14	3	1	18
Total		18	4	10	32

Table 2: Distribution of respondents by systemic reform orientation and gender

		Gender		
		Male	Female	Total
syst	not	7	7	14
	syst	11	7	18
Total		18	14	32

Table 3: Distribution of respondents by systemic reform orientation and age range

		Age Range			
		30-39	40-49	50+	Total
syst	not	2	1	11	14
	syst	2	2	14	18
Total		4	3	25	32

Table 4: Distribution of respondents by systemic reform orientation and years of experience in STEM field range

		YrsinSTEM2						
		1-5 years	6-10 years	11-15 years	16-20 years	21-25 years	26 years and +	Total
Syst	not	4	3	3	3	0	1	14
	syst	3	6	3	2	3	1	18
Total		7	9	6	5	3	2	32

Table 5: Distribution of respondents by systemic reform orientation and years of experience in teaching range

		Yrsteach2					
		0 years	1-5 years	6-10 years	11-15 years	16-20 years	Total
Syst	not	7	4	1	0	2	14
	syst	8	4	2	4	0	18
Total		15	8	3	4	2	32

Table 6: Distribution of respondents by systemic reform orientation, major field and education level

EducLVL			syst		Total
			not	syst	
PhD	MajorField	Math	1	5	6
		Science	3	7	10
		Social Science	1	0	1
		Education	2	2	4
		Total	7	14	21
MA/MS	MajorField	Math	1	0	1
		Social Science	1	2	3
		Education	5	2	7
		Total	7	4	11

Table 7: Distribution of respondents by systemic reform orientation and job held in partnerships as founder

		Founder		
		True	False	Total
syst	not	10	4	14
	syst	16	2	18
Total		26	6	32

Table 8: Distribution of respondents by systemic reform orientation and job held in partnerships as teacher

		Teacher		
		True	False	Total
syst	not	7	7	14
	syst	10	8	18
Total		17	15	32

Table 9: Distribution of respondents by systemic reform orientation and job held in partnerships as evaluator

		Evaluator		
		True	False	Total
syst	not	7	7	14
	syst	8	10	18
Total		15	17	32

Table 10: Distribution of respondents by systemic reform orientation and job held in partnerships as consultant

		Consultant		
		True	False	Total
syst	not	11	3	14
	syst	16	2	18
Total		27	5	32

Table 11: Distribution of responses to question 13d "As a reviewer I think the outcomes predicted are likely to be impacted by factors outside of the partnership's control", by systemic reform orientation .

	Not systemic orientation	Systemic orientation	Total
Strongly agree/ Agree	5	12	17
Neither	4	2	6
Strongly disagree / Disagree	4	2	6
No opinion	1	0	1
total	14	16	30

Table 12: Distribution of responses to question 13k "As a reviewer I would approve funding for this project.", by systemic reform orientation .

	Not systemic orientation	Systemic orientation	Total
Strongly agree/ Agree	8	13	21
Neither	2	0	2
Strongly disagree / Disagree	2	4	6
No opinion	1	0	1
total	14	16	30

Table 13: Distribution of responses to question 18a "Power was Invested in One Individual during Formation and Operation", by gender

	Men	Women	Total
Strongly agree	2	0	2
Agree	8	3	11
Neither	4	0	4
Disagree	1	2	3
Strongly disagree	2	7	9
No opinion	1	0	1
Total	18	12	30

Table 14: Distribution of responses to question 18b "Power was Invested in One Organization during Formation and Operation", by gender

	Men	Women	Total
Strongly agree	4	1	5
Agree	8	4	12
Neither	3	0	3
Disagree	1	2	3
Strongly disagree	2	5	7
No opinion	1	0	1
Total	18	12	30

Table 15: Distribution of responses to question 18c "Power was Shared Equally during Formation and Operation", by gender

	Men	Women	Total
Strongly agree	2	1	3
Agree	5	8	13
Neither	1	1	2
Disagree	8	2	10
Strongly disagree	1	0	1
No opinion	1	0	1
Total	18	12	30

Table 16: Distribution of responses to question 18a "Power was Invested in One Individual during Formation and Operation", by gender

	Men	Women	Total
Agree/Strongly agree	10	3	13
Neither	4	0	4
Disagree/Strongly disagree	3	9	12
No opinion	1	0	1
Total	18	12	30*

*Two missing responses, both women

Table 17: Distribution of responses to question 18b "Power was Invested in One Organization during Formation and Operation", by gender

	Men	Women	Total
Agree/Strongly agree	12	5	17
Neither	3	0	3
Disagree/Strongly disagree	3	7	10
Total	18	12	30*

*Two missing responses, both women

Table 18: Distribution of responses to question 18c "Power was Shared Equally during Formation and Operation", by gender

	Men	Women	Total
Agree/Strongly agree	7	9	16
Neither	1	1	2
Disagree/Strongly disagree	9	2	11
No opinion	1	0	1
Total	18	12	30*

*Two missing responses, both women

Table 19: Distribution of responses to question 18a "Power was Invested in One Individual during Formation and Operation", by major field

	Math & Science	Education & Soc Sc	Total
Agree/Strongly agree	6	7	13
Neither	3	1	4
Disagree/Strongly disagree	8	4	12
No opinion	1	0	1
Total	18	12	30*

Table 20: Distribution of responses to question 18b "Power was Invested in One Organization during Formation and Operation", by major field of the respondents

	Math & Science	Education & Soc Sc	Total
Agree/Strongly agree	8	9	17
Neither	2	1	3
Disagree/Strongly disagree	7	3	10
No opinion	0	0	0
Total	17	13	30

Table 21: Distribution of responses to question 18c "Power was Shared Equally during Formation and Operation", by major field of the respondents

	Math & Science	Education & Soc Sc	Total
Agree/Strongly agree	8	8	16
Neither	1	1	2
Disagree/Strongly disagree	7	4	11
No opinion	1	0	1
Total	17	13	30

Table 22: Distribution of responses to question 18a "Power was Invested in One Individual during Formation and Operation", by systemic reform orientation and gender

		Other	Systemic	Total
Men	Agree/Strongly agree	4	6	10
	Neither	1	3	4
	Disagree/Strongly disagree	1	2	3
	No opinion	1	0	1
	Subtotal	*7*	*11*	*18*
Women	Agree/Strongly agree	2	1	3
	Neither	0	0	0
	Disagree/Strongly disagree	4	5	9
	Subtotal	*6*	*6*	*12*
Total		13	17	30*

Table 23:Distribution of responses to question 18b "Power was Invested in One Organization during Formation and Operation", by systemic reform orientation and gender

		Other	Systemic	Total
Men	Agree/Strongly agree	6	6	12
	Neither	0	3	3
	Disagree/Strongly disagree	1	2	3
	Subtotal	*7*	*11*	*18*
Women	Agree/Strongly agree	3	2	5
	Disagree/Strongly disagree	3	4	7
	Subtotal	*6*	*6*	*12*
Total		13	17	30*

Table 24: Distribution of responses to question 18c "Power was Shared Equally during Formation and Operation", by systemic reform orientation and gender

		Other	Systemic	Total
Men	Agree/Strongly agree	1	6	7
	Neither	1	0	1
	Disagree/Strongly disagree	4	5	9
	No opinion	1	0	1
	Subtotal	*7*	*11*	*18*
Women	Agree/Strongly agree	6	3	9
	Neither	0	1	1
	Disagree/Strongly disagree	0	2	2
	Subtotal	*6*	*6*	*12*
Total		13	17	30*

Table 25: Distribution of responses to question 14e "Please indicate the degree to which you agree (or disagree) that the following factors contribute to high levels of transaction costs for partner organizations 14.e the use of formal agreements such as contracts", by systemic reform orientation

		syst		
		not	syst	Total
	No opinion	1	0	1
	agree	5	8	13
	neither	3	4	7
	disagree	4	6	10
Total		13	18	31

Summary table of emergent themes– Open-ended question 18 "In your experience is it useful to have a formal agreement in the form of a contract or memorandum of understanding that binds the partners to a course of action? In what ways is this helpful or unhelpful" (round 2)

Financial accountability – allocation and use of funds	D172005 "absolutely when funding is involved - otherwise what's the point?" D232005 We have found it useful to have a formal agreement with the School Districts we are working with in the (PARTNERSHIP #2) and STRSI. This agreement had to be signed by the Board. Other than the contracts each university receives in the grants office receives from (PARTNERSHIP #1) fiscal, delineating the conditions of receiving the money, we have not found the need to have any other memorandum of agreement … D492005 It depends ont the nature of the partnerhsip but definitely yes if money is being shared or earned from the work D582005 Partnerships can develop at all levels of organization. If there are fiscal transactions between partners, then a contract or memorandum of understanding is helpful. D932005 I only have experience with formal agreements with regards to fiscal resources. These formal agreements are very valuable. The managing of the fiscal resources within a project has a great deal of potential for causing problem. Having agreements in place helps to prevent those problems. D252005 An MOU or contract is necessary when one of the partners is the fiscal agent for an externally funded project. Also, the MOU spells out expectations and deliverables for the funding received. D662005 Yes, a MOU or contract helpful because it provides a mechanism for the development of partnership activities that will hopefully lead to mutually beneficial educational programs conducted jointly and independently by partners. By having a formal agreement, partners are able to clearly delineate responsibilities, scope of work (support, facilitation, and collaboration), financial and service arrangements, partnership privileges, duration, and the conditions for amendment and termination.
useful starting places to help define expectations, but need to allow for modification all along the way so we can adapt as	D332005 This is highly variable. For some institutions any ambiguity is unsettling and a contract helps them feel clear and comfortable about expectations. For some, a contract feels too "binding" and doesn't allow the flexibility based on context and circumstance. In our work contracts at times were too "generic" and so it didn't really honor the fact that implementation at each partner site was slightly varied so the generic contract caused some damage because it didn't clearly and specifically define their unique requirements. We've found these kinds of "agreements" useful starting places to help define

we learn from our work and in response to changing circumstance	expectations, but need to allow for modification all along the way so we can adapt as we learn from our work and in response to changing circumstance. If the contracts were used in a punitive or overwhelmingly binding sense, it seemed to give a sense of "policing" one another's actions, as opposed to learning from our work. In most cases, when folks don't meet their obligations it has less to do with intentional noncompliance, than changing circumstances or unforeseen obstacles. So, we use the contracts as a way to discuss what did we say we'd do, what did we actually do, and what can we learn from that and therefore how do we modify the agreement for the next time period. They really need to be in the spirit of setting some goals and learning, not just for accountability. 45 This is helpful in that it provides a common document which makes it clear what action is required by whom. The agreement should not be so binding that as the project evolves and some aspects of the project change partners must be able to negotiate the changes and stay on course. 79 It's helpful, I think, to have some sort of document just to make sure that everyone knows what they are getting into. It's also possible that these documents can be somewhat fluid, with modifications occurring over time. 37 I'm not certain this is necessary, but it might eliminate a confusion of expectations. However, we have found that the work needs to be somewhat fluid. We have had to modify as we became more clear of the working environment and challenges in implementation. If we were tied to a rigid course of action, we would be hamstrung to truly do the work needed.
Organization of work, assignment of responsibilities	D81 Yes, it is useful. "Good fences make good neighbors," according to Robert Frost. Until our partnership developed its implementation plan drawing from the strategic plan based on our proposal, expectations were not clear about who was responsible for what by when. When we added a column for what evidence would indicate that the step had been taken, we clarified understandings and expectations. Allowing everyone the opportunity to develop, review and modify the plan before it is adopted builds shared responsibility. That does not limit us from amending the agreement, but helps us to clarify how to realize our vision. We used that plan as the specifications for our subcontracts, and attached it to each one. D972005 We're actually going through this right now. We did not clearly delineate the expectations of all partners in a formal way at the beginning of the partnership, and now we need to do this (partially due to pressure from NSF). From some partners, we are not getting the cooperation in some areas (e.g., getting needed data). 83 I think it is very helpful to create a sense of mutual accountability and the formal agreements do that. In our case each school board formally approved the partnering agreement as did the city and university. I think that the agreement helped us hold our own organizations to the agreement when situations arose where there was pressure to do something different - not approve funds for staff development, make staffing adjustments that would hurt the program, etc. 59 I've found that a formal agreement is helpful if it clarifies expectations for participants. If a formal agreement is enacted because there is an initial lack of trust that the participants will fulfill their commitments, then it is not helpful. Its always important to have clarity about tasks and products, especially where funds are exchanged. This should be part of communication strategy not a punishment for an assumed lack of performance. D662005 Yes, a MOU or contract helpful because it provides a mechanism for the development of partnership activities that will hopefully lead to mutually beneficial educational programs

	conducted jointly and independently by partners. By having a formal agreement, partners are able to clearly delineate responsibilities, scope of work (support, facilitation, and collaboration), financial and service arrangements, partnership privileges, duration, and the conditions for amendment and termination.
Trust and communication are more effective for compliance	D612005 It depends. In the case of a newly developed partnership where members do not have a history of working together, it is useful to have a formal agreement. In the case of an established partnership pursuing a continuation project, it may not matter. However, in the case of an existing partnership moving in a new direction, a formal agreement might address critical details such as changes in cost-sharing or roles that may change as a result of new directions. D592005 I've found that a formal agreement is helpful if it clarifies expectations for participants. If a formal agreement is enacted because there is an initial lack of trust that the participants will fulfill their commitments, then it is not helpful. Its always important to have clarity about tasks and products, especially where funds are exchanged. This should be part of communication strategy not a punishment for an assumed lack of performance. D442005 I've had cases where it's been useful to have the formal contract, but usually, it only important to our business office (and we often begin the work of partnerships before formal agreements are in place, and we rarely have gotten burned. D532005 No, a handshake is all that is needed at the operational level yet adminstration unfortunately requires formallity and formal agreements to protect the respective institutions for fiscal and legal reasons. D782005 It is often necessary, as a requirement of grant funding or the award of a sub grant. Then it is also appropriate. When not required for these reasons, I feel from experience it is better to proceed on the basis of informal agreements or memoranda of understandings, to maximize flexibility and productivity.
Compliance	D972005 We're actually going through this right now. We did not clearly delineate the expectations of all partners in a formal way at the beginning of the partnership, and now we need to do this (partially due to pressure from NSF). From some partners, we are not getting the cooperation in some areas (e.g., getting needed data). D362005 A memorandum of understanding seems useful. Essentially it provides an external criterion to consider whenever there are conflicts in the partnership. I don't think it needs to be completely binding and certainly needs to be somewhat flexible, but should include a specification of what each organization will do as a part of the partnership and what each will gain from the other partners. D412005 It is helpful and necessary to have a clear delineation of tasks and responsibilities of each partner agreed upon and written in the event there is disagreement at some later date. D832005 I think it is very helpful to create a sense of mutual accountability and the formal agreements do that. In our case each school board formally approved the partnering agreement as did the city and university. I think that the agreement helped us hold our own organizations to the agreement when situations arose where there was pressure to do something different - not approve funds for staff development, make staffing adjustments that would hurt the program, etc.

Setting of mission and goals (maybe similar to a plan, or strategic plan)	D332005 This is highly variable. For some institutions any ambiguity is unsettling and a contract helps them feel clear and comfortable about expectations. For some, a contract feels too "binding" and doesn't allow the flexibility based on context and circumstance. In our work contracts at times were too "generic" and so it didn't really honor the fact that implementation at each partner site was slightly varied so the generic contract caused some damage because it didn't clearly and specifically define their unique requirements. We've found these kinds of "agreements" useful starting places to help define expectations, but need to allow for modification all along the way so we can adapt as we learn from our work and in response to changing circumstance. If the contracts were used in a punitive or overwhelmingly binding sense, it seemed to give a sense of "policing" one another's actions, as opposed to learning from our work. In most cases, when folks don't meet their obligations it has less to do with intentional noncompliance, than changing circumstances or unforeseen obstacles. So, we use the contracts as a way to discuss what did we say we'd do, what did we actually do, and what can we learn from that and therefore how do we modify the agreement for the next time period. They really need to be in the spirit of setting some goals and learning, not just for accountability. D772005 a memorandum of understanding is important as an instrument of mutual commitment to a clearly identified purpose and overall direction. D952005 Contracts are very helpful. They can spell out original intents so new people know what has been committed or people who decided they don't want to continue so activity committed to. D832005 I think it is very helpful to create a sense of mutual accountability and the formal agreements do that. In our case each school board formally approved the partnering agreement as did the city and university. I think that the agreement helped us hold our own organizations to the agreement when situations arose where there was pressure to do something different - not approve funds for staff development, make staffing adjustments that would hurt the program, etc. D772005 a memorandum of understanding is important as an instrument of mutual commitment to a clearly identified purpose and overall direction. D832005 I think it is very helpful to create a sense of mutual accountability and the formal agreements do that. In our case each school board formally approved the partnering agreement as did the city and university. I think that the agreement helped us hold our own organizations to the agreement when situations arose where there was pressure to do something different - not approve funds for staff development, make staffing adjustments that would hurt the program, etc. D952005 Contracts are very helpful. They can spell out original intents so new people know what has been committed or people who decided they don't want to continue so activity committed to.

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